LDEOC/EOEC SURVEILLANCE PANEL

A LDEOC/EOEC conference call was held on Friday, January 20th, 9 am Central Standard Time. The following members were on the call:

Mike Lopez - Intertek
Joe Franklin - Intertek
Kimberly Hernandez - Intertek
Mike Birke – SwRI
Michelle Holzer – SwRI
Charles Nystrom - SwRI
Jason Bowden – OHT
Doyle Boese – Infineum
Vince Donndelinger – Lubrizol
Conika Own-Robinson – Savant
Maggie Smerdon - Savant
Tina Dasbach - Savant
Greg Miiller - Savant
Norm Kanar - Savant
Dennis Gaal - ExxonMobil
Mike Kasimirsky - TMC
Frank Farber – TMC
Jeff Clark - TMC
Kaustav Sinah - Chevron
Robert Stockwell - Chevron
Geifu Wu – Valvoline
Bernadette Hofmann – ISP
Michael Johnscher - ISP

Doyle Boese went over his presentations (attached). The TMC out of control analysis process is primarily for detection of recent change and assignment of cause, where the concern with LDEOC is lab differences existing for long term. In the past, Doyle had conducted a larger study, which he feels is more appropriate for this situation, though it actually utilizes many of the same concepts, but with a long term focus in lieu of focusing on a few recent results. Looking at the control charts the K values used to generate the plots, they appear to be arbitrary, and never officially approved. Doyle did state they are in the ball park of what is used in other tests. Using a large number of sample results, the study revealed there is more of an issue with severity, as opposed to precision. This may be due to the batch to batch variability. With large sample sizes, small changes can be picked up as statistically significant. The study revealed that no lab is always severe or always mild for each material on a given parameter. The group was updated on the details of the light duty class panel call last Friday, 1-13-17. The Class Panel sent the correction factor back to the surveillance panel for further consideration because, in their judgement, it was premature given that there were several unresolved issues – one of which is that the test *may* be out-of-control   Labs that can still pass ACM-1 are able to still run, however the vast majority of the labs are unable to calibrate. The instructions from the class panel were to set up LTMS charting, and if possible, get all the labs on the same batch.   Jason Bowden asked the question of how the precision statement found in D471 relates to the data distribution found in the study. Jeff Clark noted that D4485 references oil 1006, and that the concern of TMC is that all labs are not providing equivalent results, despite the floating limits found on some of the limits found in the spec. Doyle noted that the LTMS system will help with that concern. Joe Franklin pointed out that the purpose of putting in the floating limits in the first place was to adjust for lab differences. Frank Farber of TMC says their primary interest is eliminating lab differences. To that end, at the class panel meeting last week, it was suggested the labs should all be running the same batches. The surveillance panel was quick to point out that the batches are too small and come out too often for this to be possible. Doyle pointed out that all labs running the same batch may not be necessary, as long as data is on the next batch before it is put into use. For this to happen, OHT will have to send out the next batch at least a month before the current batch runs out, and since they don't know the lab's consumption rates, it would be a very difficult to implement. TMC was given a directive from the surveillance panel to establish a LTMS system.   Dennis Gaal suggested it may be best to start with just ACM-1 so labs can start calibrating. Doyle stated that looking at all the parameters of all the materials at once is preferred, and TMC stated that once one material is set up, the majority of the work is done, so setting the others up is not too much work. Joe Franklin stated that implementing a LTMS will identify a shift in a lab, but will not fix the test process. Joe also asked Mike Birke for a timeline regarding how long it will take to fix the ACM-1 issue. An engine test industry meeting is being held at Southwest Research Institute for the week of February 6th, and Joe commented that a face to face meeting with the participating labs would speed the process up. Geifu Wu commented that the plausible explanation for the ACM-1 increased volume swell trend may be a problem with the materials batch to batch consistency based on data analysis.   Greg Miiller agreed, saying their lab has all new instrumentation, and they are confident the material is the source of error, not the labs. Jason Bowden had a question as to the status of the FKM aging experiment at Southwest. The material is currently in the bath and will be shipped out for post- test measurements on January 31st. Also the durometer blocks have been shipped out to ISP for measurements. ISP has received them, and will send them on to the next lab when they are finished with the measurements.   Labs will continue to test ACM-1, but try different batches to see if the trend continues. Intertek has run three tests with batch 19, and they see the same volume swell issue. There will be a teleconference with the participating labs to discuss test improvement and the hardware survey, with focus on the Instron instrument in the near future.

The call ended at 10:05 am.

LDEOC – OUT OF CONTROL ANALYSIS

D. Boese
January 6, 2017

Performance you can rely on.

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Analysis Process

- Out of Control Analysis Process is primarily for detection of recent change and assignment of cause.
- Concern with LDEOC is lab differences existing for long term.
- Recent (HUGE) analysis, in author's opinion, is more appropriate for this situation though it actually utilizes many of the same concepts but with a long term focus in lieu focusing on a few recent results.

Summary of LDEOC Control Charts

Elastomer	Parameter	Severity		Precision	
		% Within Warning	% Action	% Within Warning	% Action
Ethylene Acrylate	Volume Change, %	13.9	33.7	9.4	3.9
	Hardness Change, pts	60.3	12.3	11.0	14.4
	Tensile Strength Change, %	9.5	2.5	5.7	3.8
Fluoroelastomer	Volume Change, %	20.1	14.1	14.0	10.0
	Hardness Change, pts	11.1	5.1	9.5	4.2
	Tensile Strength Change, %	7.2	2.7	7.1	3.2
Hydrogenated Nitrile	Volume Change, %	18.5	52.3	0.6	3.3
	Hardness Change, pts	12.1	8.4	6.5	3.0
	Tensile Strength Change, %	15.9	15.9	3.6	1.4
Polyacrylate	Volume Change, %	13.2	39.3	4.7	5.0
	Hardness Change, pts	18.2	21.5	9.4	6.4
	Tensile Strength Change, %	14.0	65.8	6.1	2.5
Silicone	Volume Change, %	5.4	2.4	10.4	5.0
	Hardness Change, pts	12.6	5.3	2.3	0.8
	Tensile Strength Change, %	9.8	79.7	13.5	6.4

EOEC LAB EFFECT ANALYSIS

D. Boese
January 3, 2017

Performance you can rely on.

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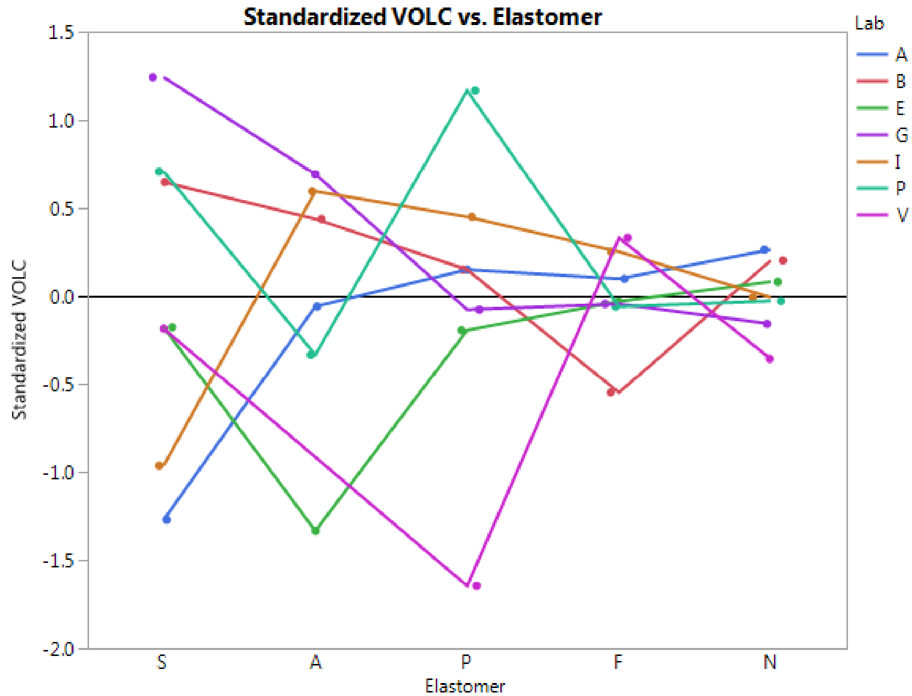
Summary

- For each parameter / material combination except Polyacrylate TENS, Lab effect is strongly statistically significant.
  - The sample sizes are large.
  - Statistically significant differences between labs may not be practically significant.
  - This analysis determines statistical significance but not practical significance.
- For each parameter, no lab is on the same side of the average (either above or below) for all materials.

Standardization Plots

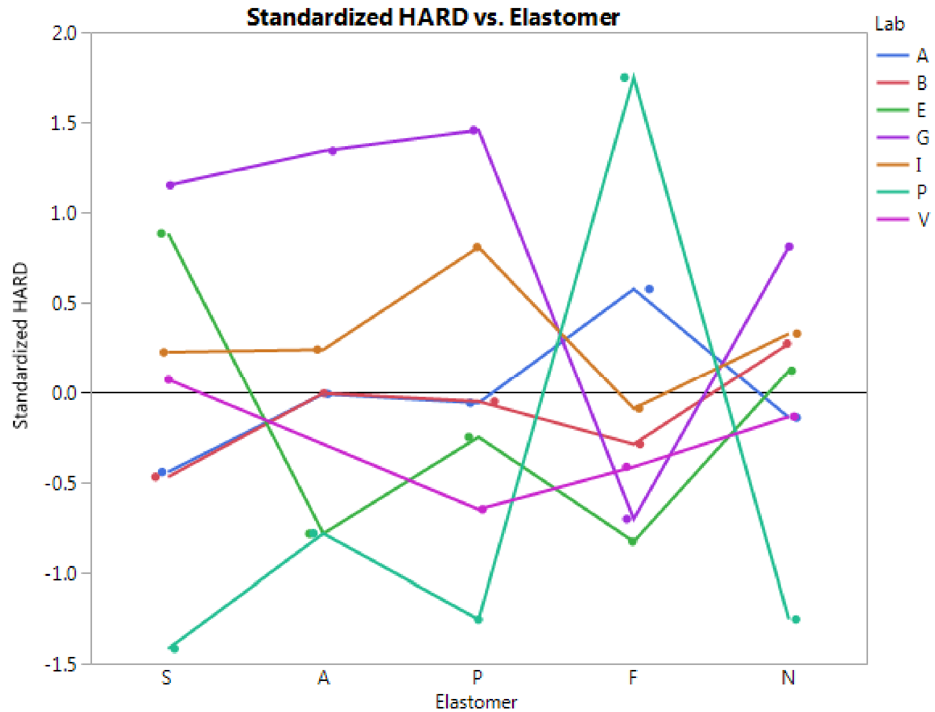
- The appendix includes plots of each of the parameters (VOLC, HARD and TENS) for each of the materials (Ethylene Acrylate, Fluoroelastomer, Nitrile, Polyacrylate, and Silicone).
- Due to the vast amount of information in the appendix, a means of distilling the data into a smaller number of slides was desired.
- The following 3 slides includes a plot for each of the parameters.
  - On each plot, the standardized lab LS Mean for each of the materials is plotted.
  - The standardized lab LS Mean = (lab LS Mean – average of all labs)/standard dev.
  - The standard deviation is the RMSE for the model generated by regressing the parameter result on Lab and Batch.

Standardized VOLC



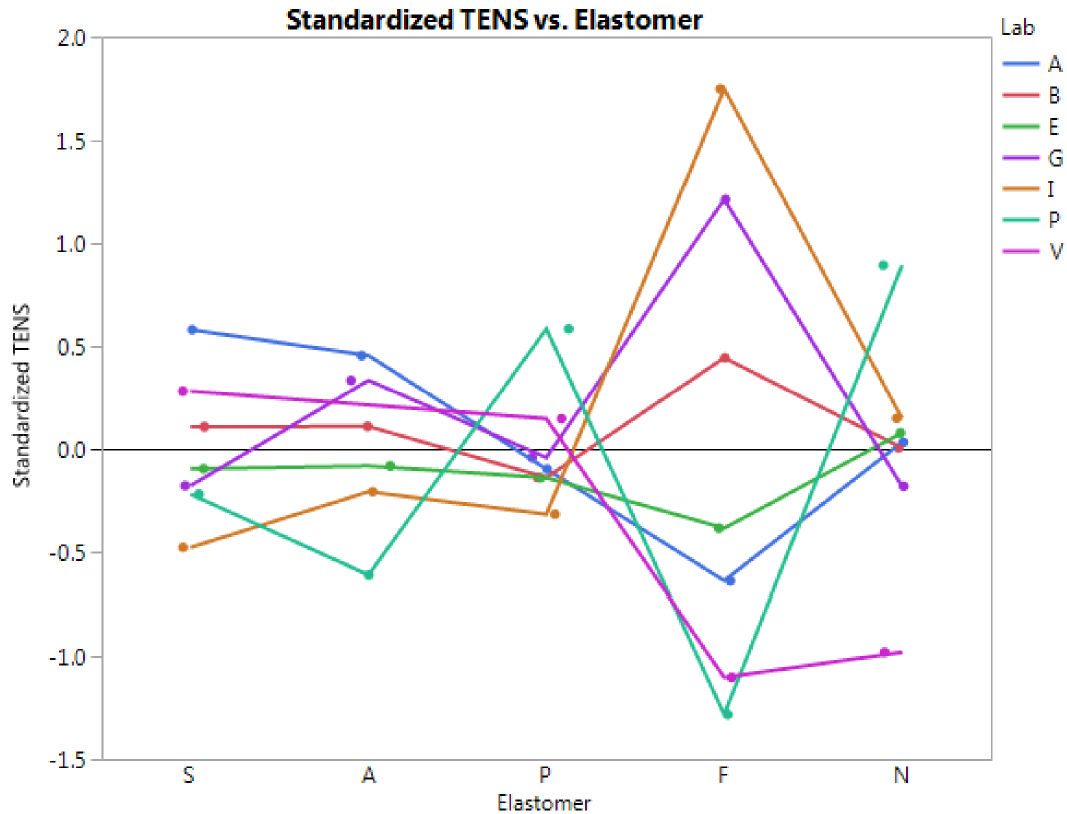
- None of the labs are above (or below) the average for all 5 materials.
- The range of deviation is narrower for Fluoroelastomer and Nitrile.
- Labs B and G are > 0.5 standard deviations above the average for both Silicone and Ethylene Acrylate.
- The extremes for Polyacrylate is from Labs P and V resulting from 6 total samples.

Standardized HARD



- None of the labs are above (or below) the average for all 5 materials.
- Other than for Lab P, the range of deviation is narrower for Fluoroelastomer and Nitrile .
- Lab G is > 0.5 standard deviations above the average for both Silicone, Ethylene Acrylate and Polyacrylate.

Standardized TENS



- None of the labs are above (or below) the average for all 5 materials.
- Contrary to VOLC and HARD, the range of deviation is widest for Fluoroelastomer and Nitrile .

APPENDIX

Performance you can rely on.

Data

- Data is as of December 22, 2016.
- Data was obtained from TMC web site.
- Excluded tests with Validity Codes having the following first letters:
  - L: Operationally invalid as determined by lab, not in stats
  - R: Operationally invalid, reported as valid by lab, not in stats
  - X: Aborted, not in stats

ETHYLENE ACRYLATE

Performance you can rely on.

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Ethylene Acrylate Data

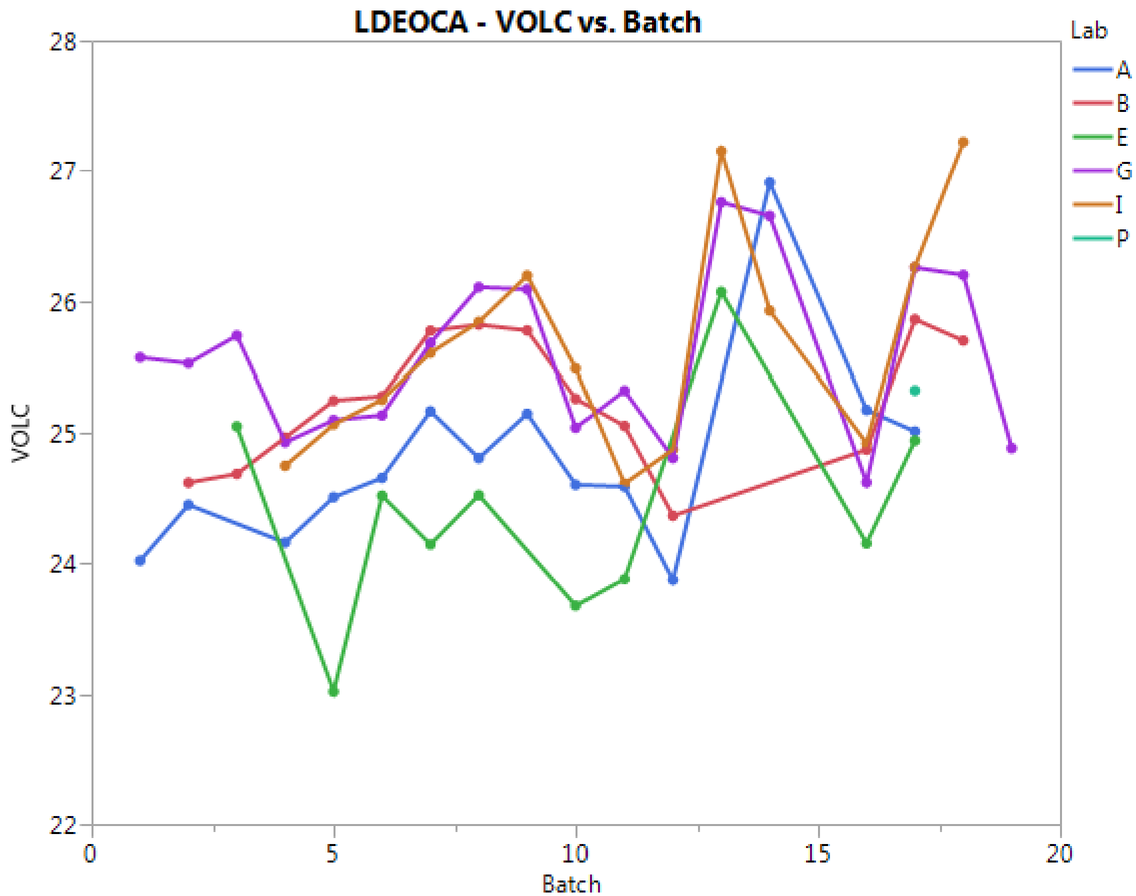
- Excluded:
  - VOLC
    - Testkey 74164 – likely typo – 16.84 in lieu of 26.84

Ethylene Acrylate Sample Size

Batch	Sample Size						
	Total	Lab A	Lab B	Lab E	Lab G	Lab I	Lab P
1	9	8	0	0	1	0	0
2	6	2	2	0	2	0	0
3	35	0	20	1	14	0	0
4	43	13	6	0	12	12	0
5	40	11	7	1	13	8	0
6	82	33	11	2	19	17	0
7	63	23	9	3	16	12	0
8	72	11	17	7	23	14	0
9	70	22	24	0	14	10	0
10	63	13	20	2	18	10	0
11	57	21	10	4	12	10	0
12	57	12	17	0	11	17	0
13	9	0	0	2	6	1	0
14	62	25	0	0	26	11	0
16	74	28	19	2	15	10	0
17	71	19	5	6	23	15	3
18	24	0	3	0	20	1	0
19	3	0	0	0	3	0	0

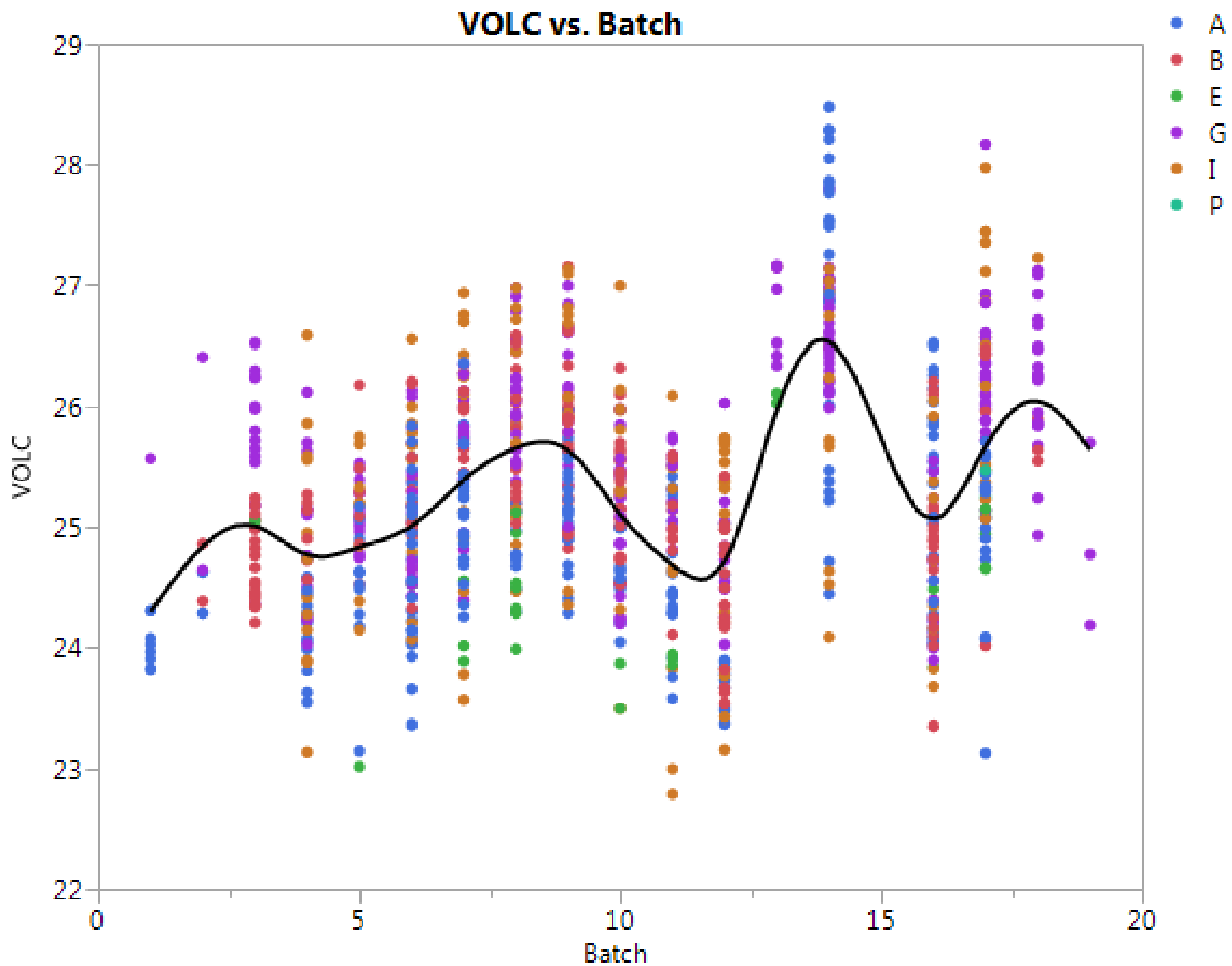
ETHYLENE ACRYLATE VOLC

Batch Average Ethylene Acrylate VOLC by Lab

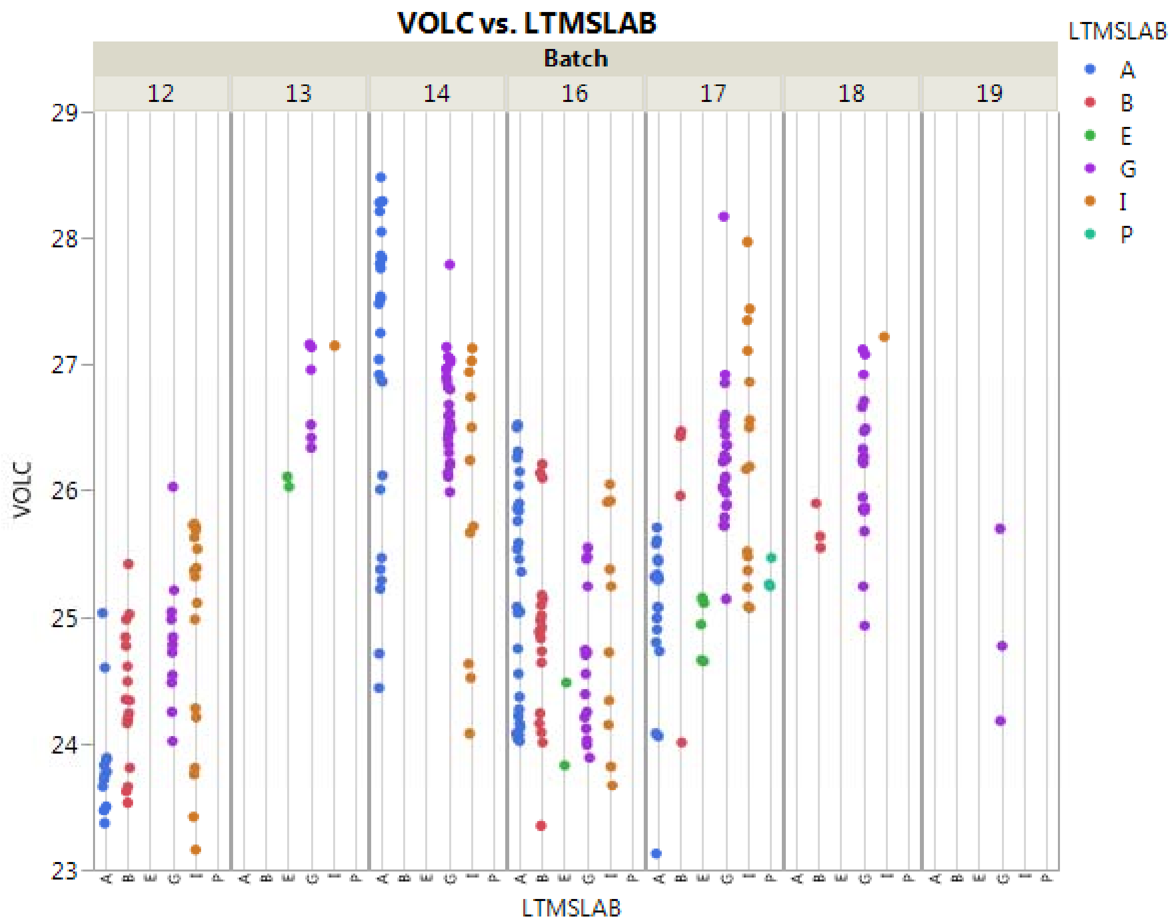


Labs B, G and I yield similar Volume Change.

Individual Ethylene Acrylate VOLC by Batch and Lab



Individual Ethylene Acrylate VOLC by Batch and Lab (Batches 12 – 19)



For most batches, the results of each lab overlaps.

Ethylene Acrylate VOLC Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

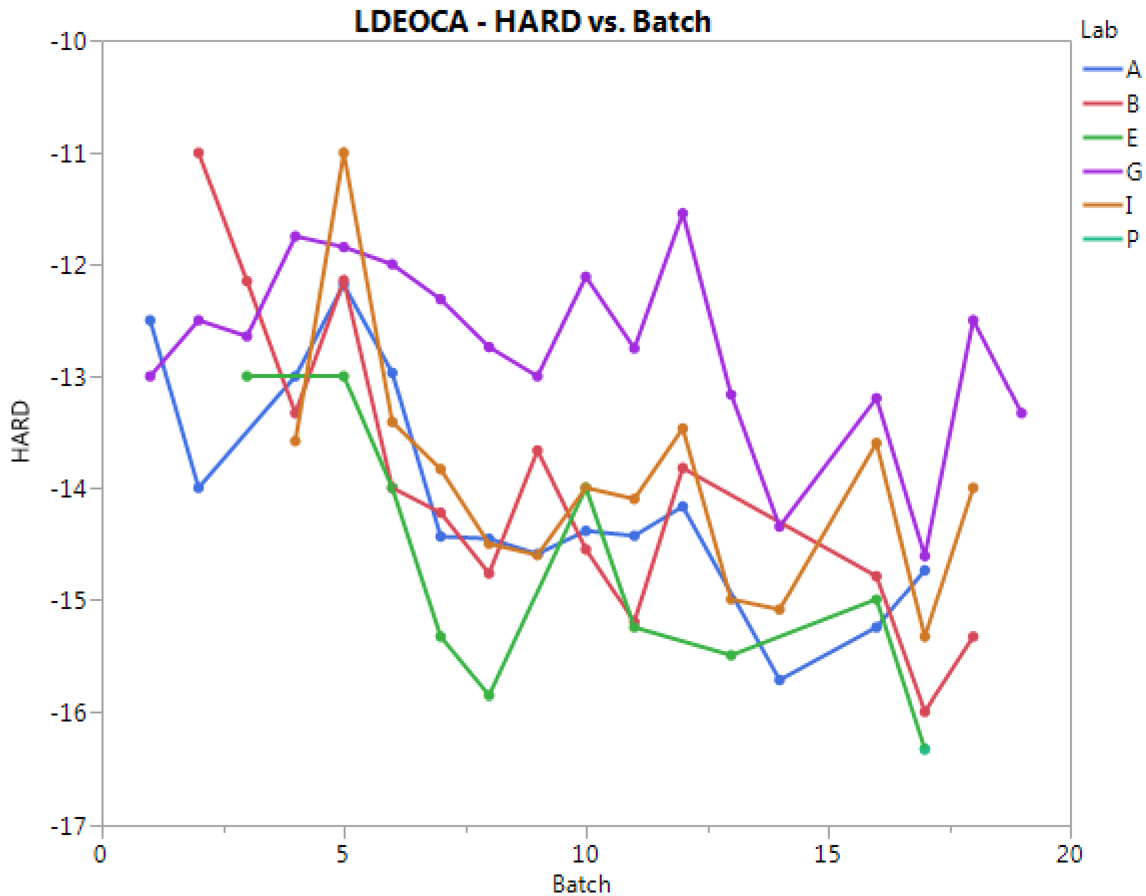
Effect	df	F Ratio	p-Value
Batch	17	30.4997	<.0001
LTMSLAB	5	31.6072	<.0001

Lab	Level			LS Mean
G	1			25.51
I	1			25.44
B	1			25.32
A		2		24.96
P	1	2	3	24.75
E			3	24.01

Labs not connected by the same Level (number) are statistically significantly different.

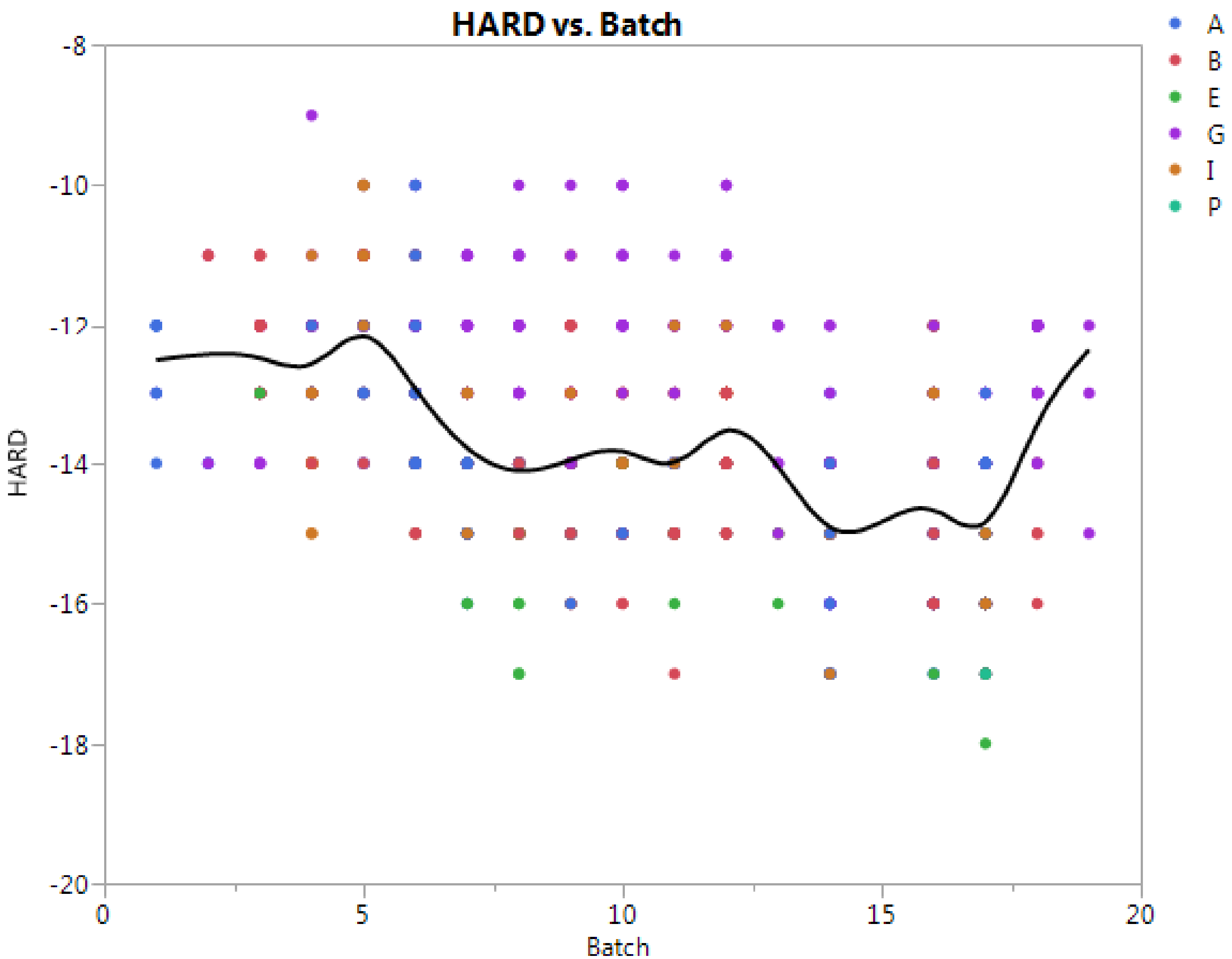
ETHYLENE ACRYLATE HARD

Batch Average Ethylene Acrylate HARD by Lab



- Lab G frequently has the least Hardness Change (absolute value) and Lab E the highest (absolute value).

Individual Ethylene Acrylate HARD by Batch and Lab



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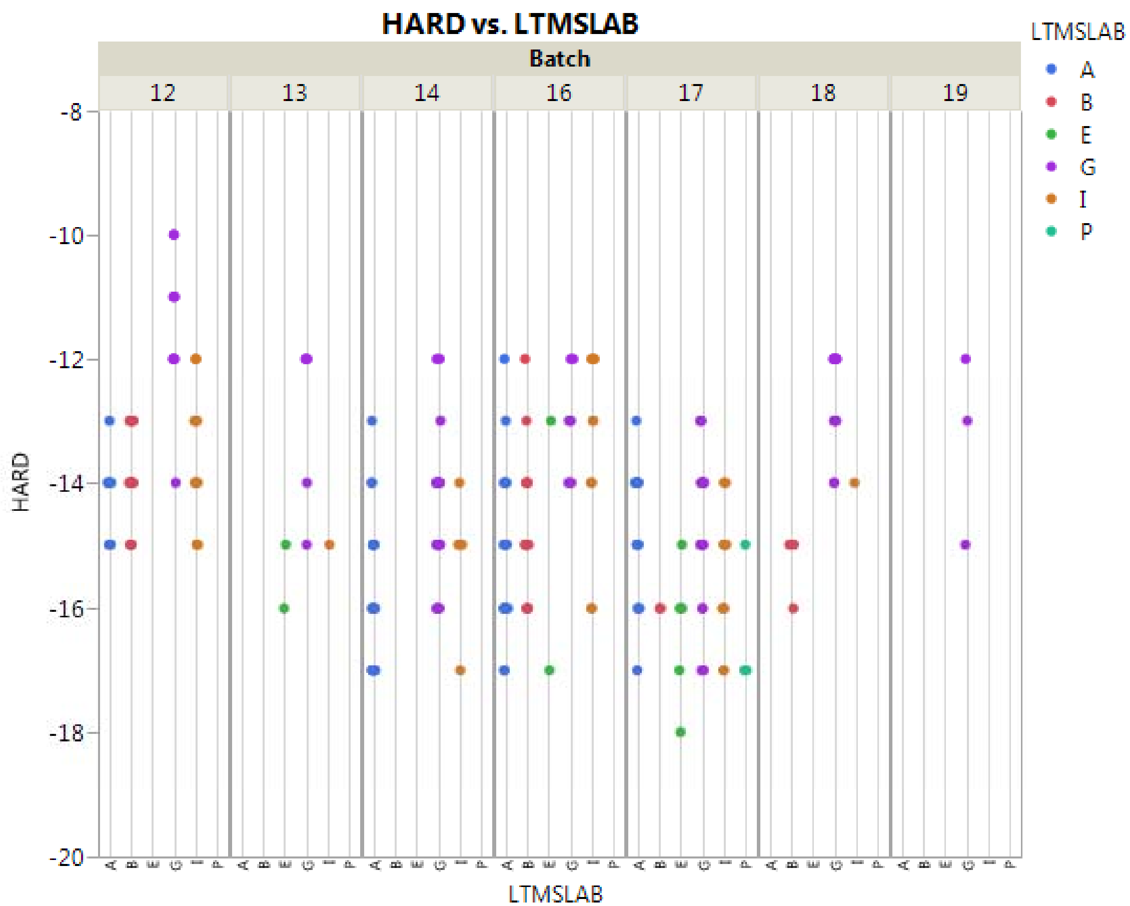
Individual Ethylene Acrylate HARD by Batch and Lab (Batches 12 – 19)



The results of the labs overlaps for each of the batches.

Ethylene Acrylate HARD Regression Analysis

- HARD was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's HSD multiple comparison test.
  - Note that the order of Labs is the same as for VOLC though the pairings of which labs are statistically significant differs.

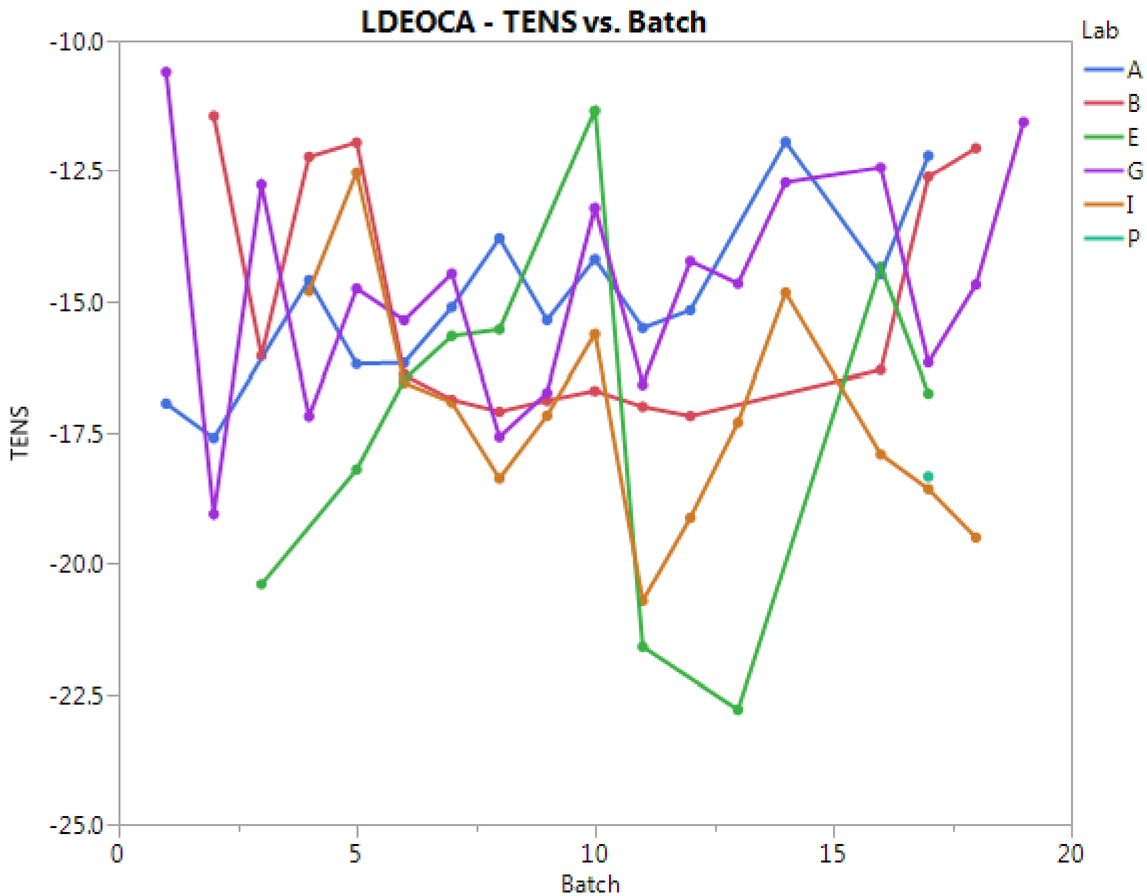
Effect	df	F Ratio	p-Value
Batch	17	32.9048	<.0001
LTMSLAB	5	62.8266	<.0001

Lab	Level		LS Mean
G	1		-12.61
I	2		-13.77
B	2		-14.02
A	2		-14.03
P	2	3	-14.84
E		3	-14.84

Labs not connected by the same Level (number) are statistically significantly different.

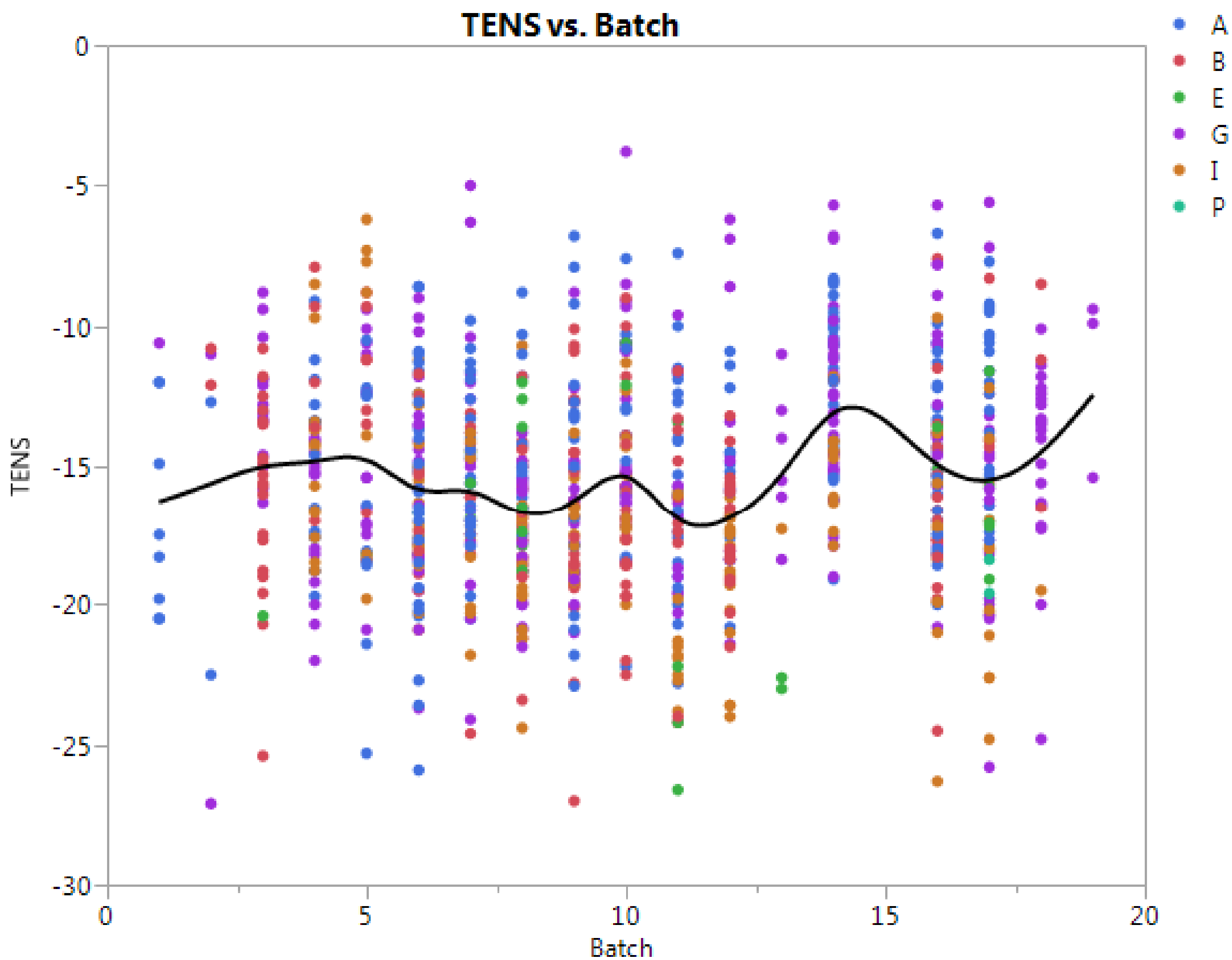
ETHYLENE ACRYLATE TENS

Batch Average Ethylene Acrylate TENS by Lab



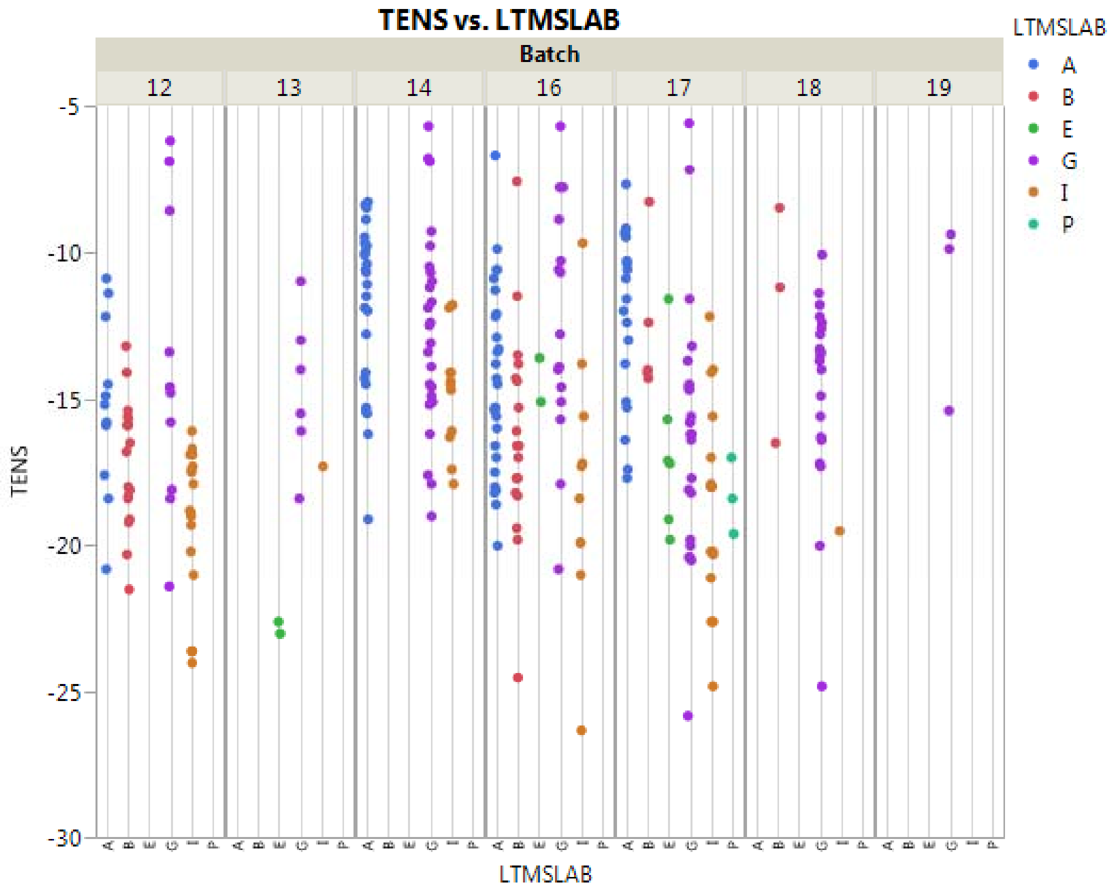
For the last several batches, Lab I has among the highest absolute TENS.

Individual Ethylene Acrylate TENS by Batch and Lab



Performance you can rely on.

Individual Ethylene Acrylate TENS by Batch and Lab (Batches 12 – 19)



For each batch, there is overlap of results for each lab.

Ethylene Acrylate TENS Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's HSD multiple comparison test.

Effect	df	F Ratio	p-Value
Batch	17	4.4337	<.0001
LTMSLAB	5	9.6758	<.0001

Lab	Level			LS Mean
A	1			-14.55
G	1	2		-14.99
B		2	3	-15.81
E	1	2	3	-16.51
I			3	-16.97
P	1	2	3	-18.45

Labs not connected by the same Level (number) are statistically significantly different.

FLUOROELASTOMER

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Fluoroelastomer Data

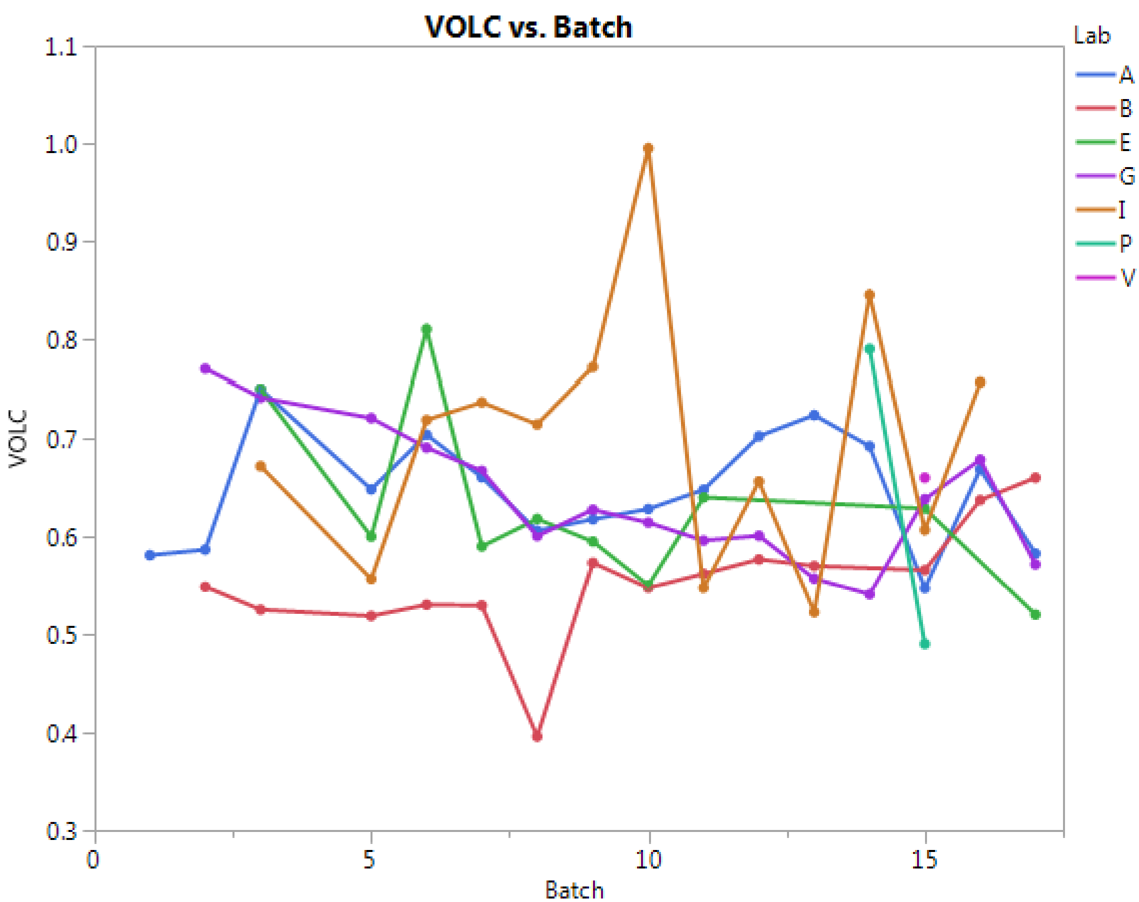
- There were a small number of apparent outliers though not enough to significantly skew the results so they were left in the analysis but the axes were adjusted to exclude them yielding a better scale for distinguishing reasonable differences.

Fluoroelastomer Sample Size

Batch	Sample Size							
	Total	Lab A	Lab B	Lab E	Lab G	Lab I	Lab P	Lab V
1	10	10	0	0	0	0	0	0
2	31	3	20	0	8	0	0	0
3	49	8	8	1	21	11	0	0
5	42	11	7	1	14	9	0	0
6	67	23	10	1	16	17	0	0
7	90	40	15	3	20	12	0	0
8	59	10	13	5	17	14	0	0
9	69	21	25	2	15	6	0	0
10	66	16	20	2	14	14	0	0
11	58	18	16	1	15	8	0	0
12	46	17	9	0	12	8	0	0
13	54	21	4	0	13	16	0	0
14	66	23	0	0	38	4	1	0
15	68	14	14	7	11	19	2	1
16	30	7	11	0	6	6	0	0
17	32	11	1	1	19	0	0	0

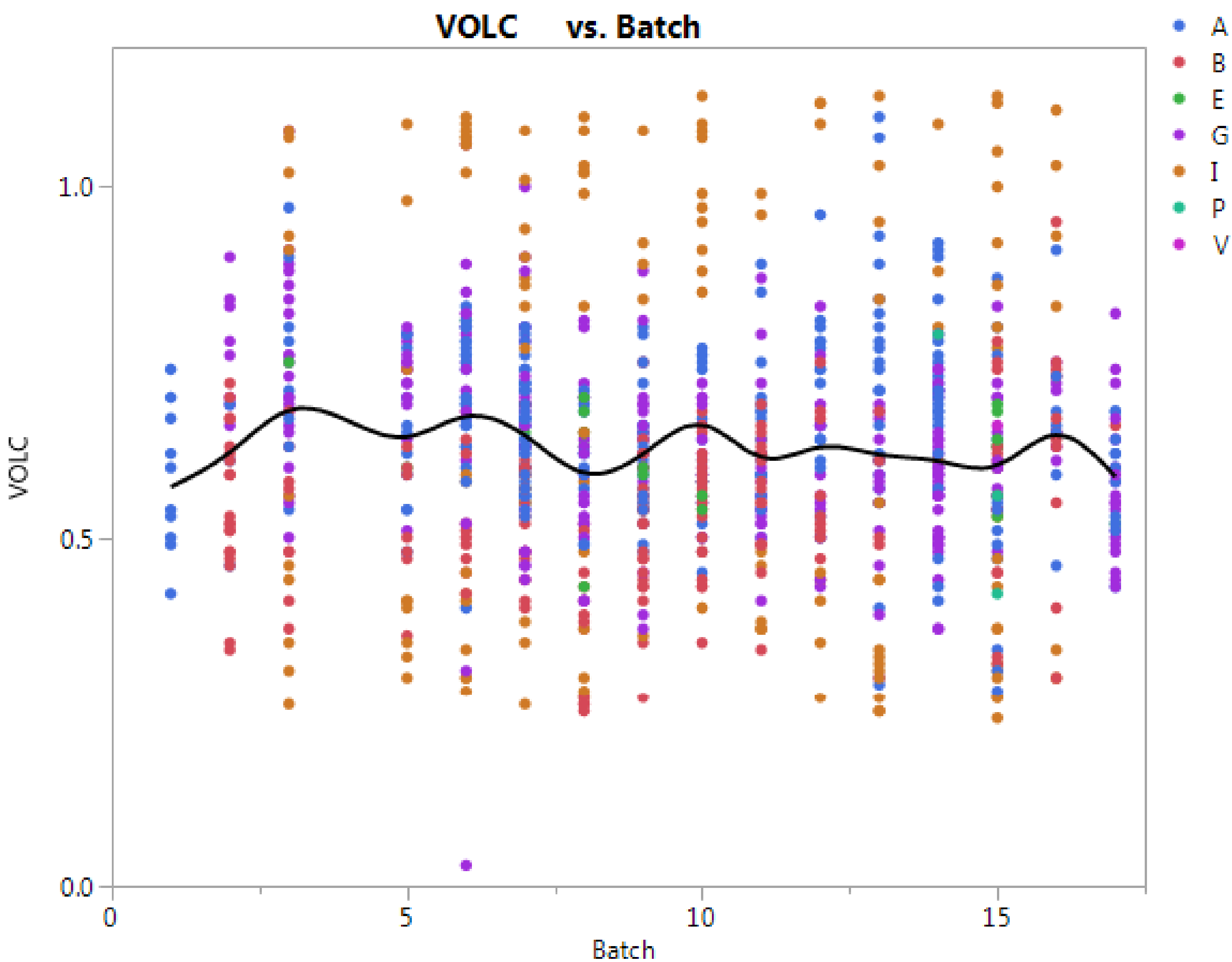
FLUOROELASTOMER VOLC

Batch Average Fluoroelastomer VOLC by Lab

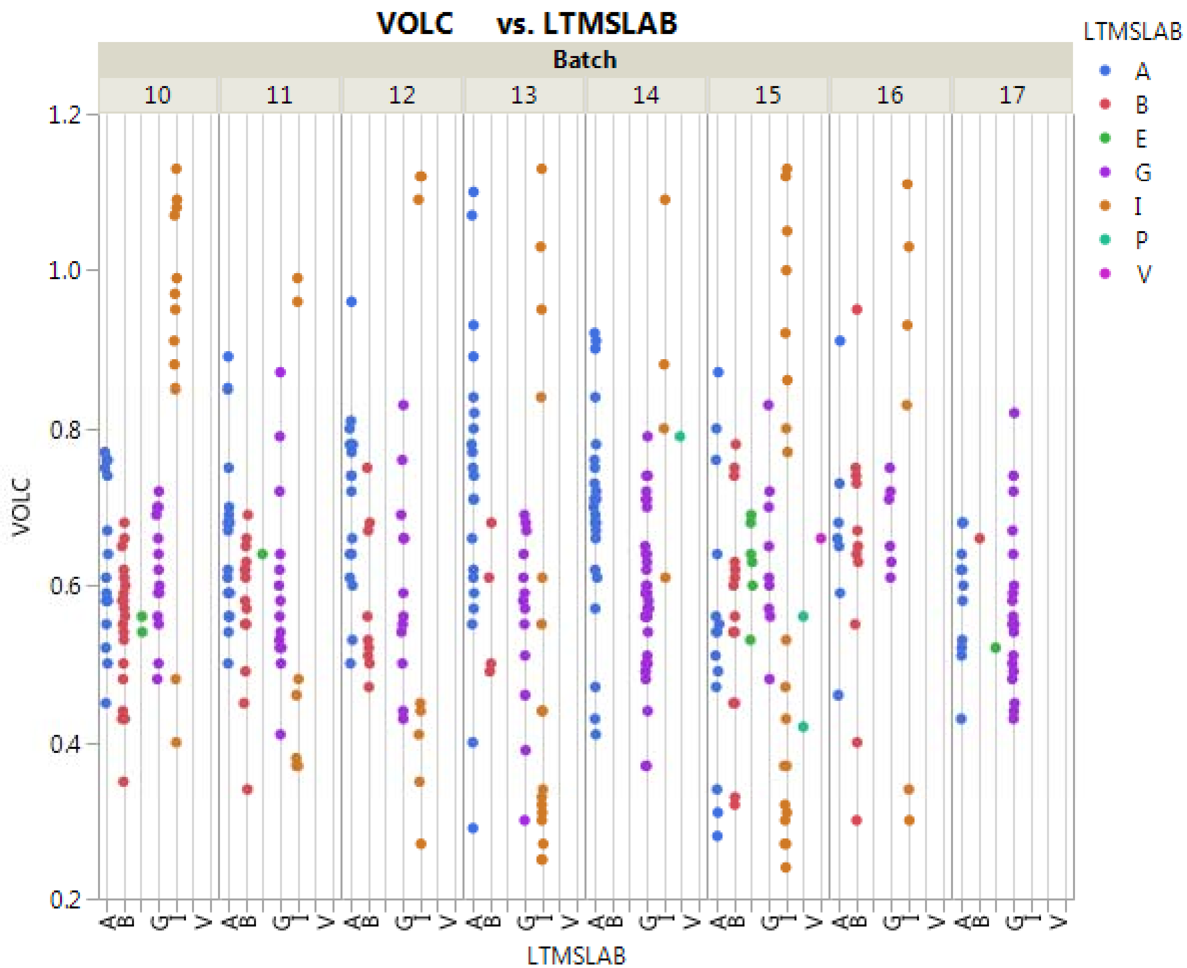


For many of the batches, Lab B has the lowest VOLC.

Individual Fluoroelastomer VOLC by Batch and Lab



Individual Fluoroelastomer VOLC by Batch and Lab (Batches 10 – 17)



- Lab I's results appear bimodal.
- For the most part, there is good overlap of results for the labs.

Fluoroelastomer VOLC Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

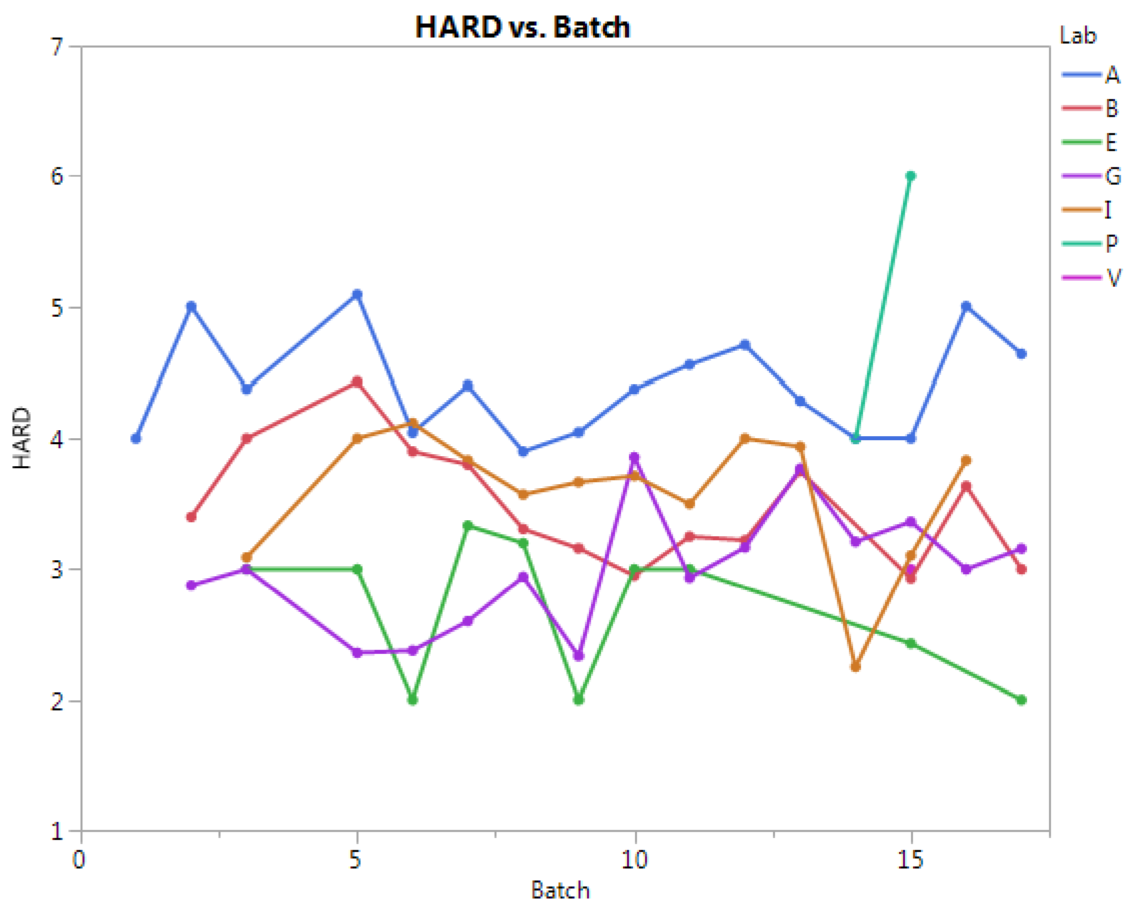
Effect	df	F Ratio	p-Value
Batch	15	2.1966	0.0054
LTMSLAB	6	9.3469	<.0001

Lab	Level		LS Mean
V	1	2	0.70
I	1		0.69
A	1		0.66
E	1	2	0.63
G	1		0.63
P	1	2	0.63
B		2	0.53

Labs not connected by the same Level (number) are statistically significantly different.

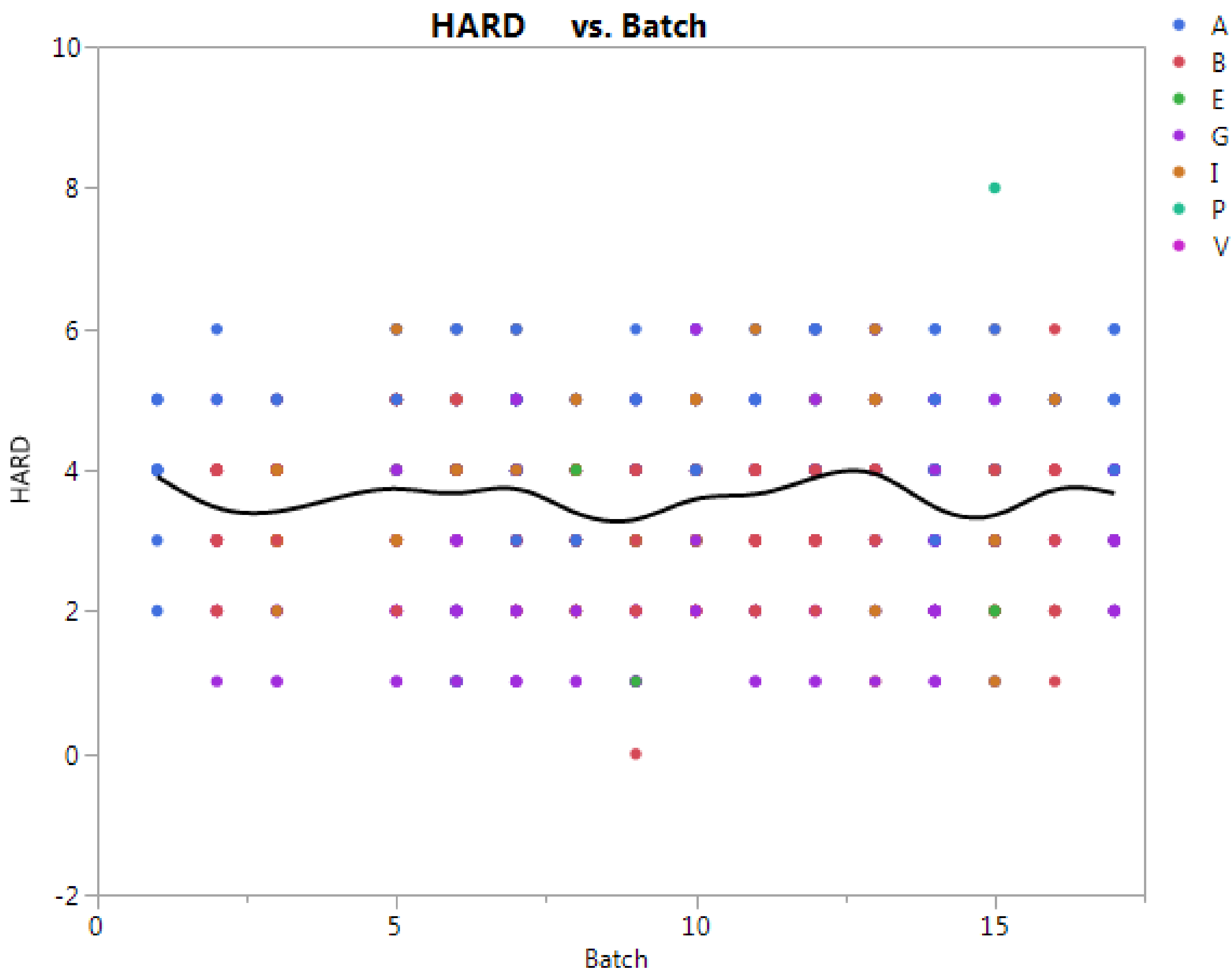
FLUOROELASTOMER HARD

Batch Average Fluoroelastomer HARD by Lab



For each batch, Lab A has among the highest HARD and Lab E among the lowest.

Individual Fluoroelastomer HARD by Batch and Lab



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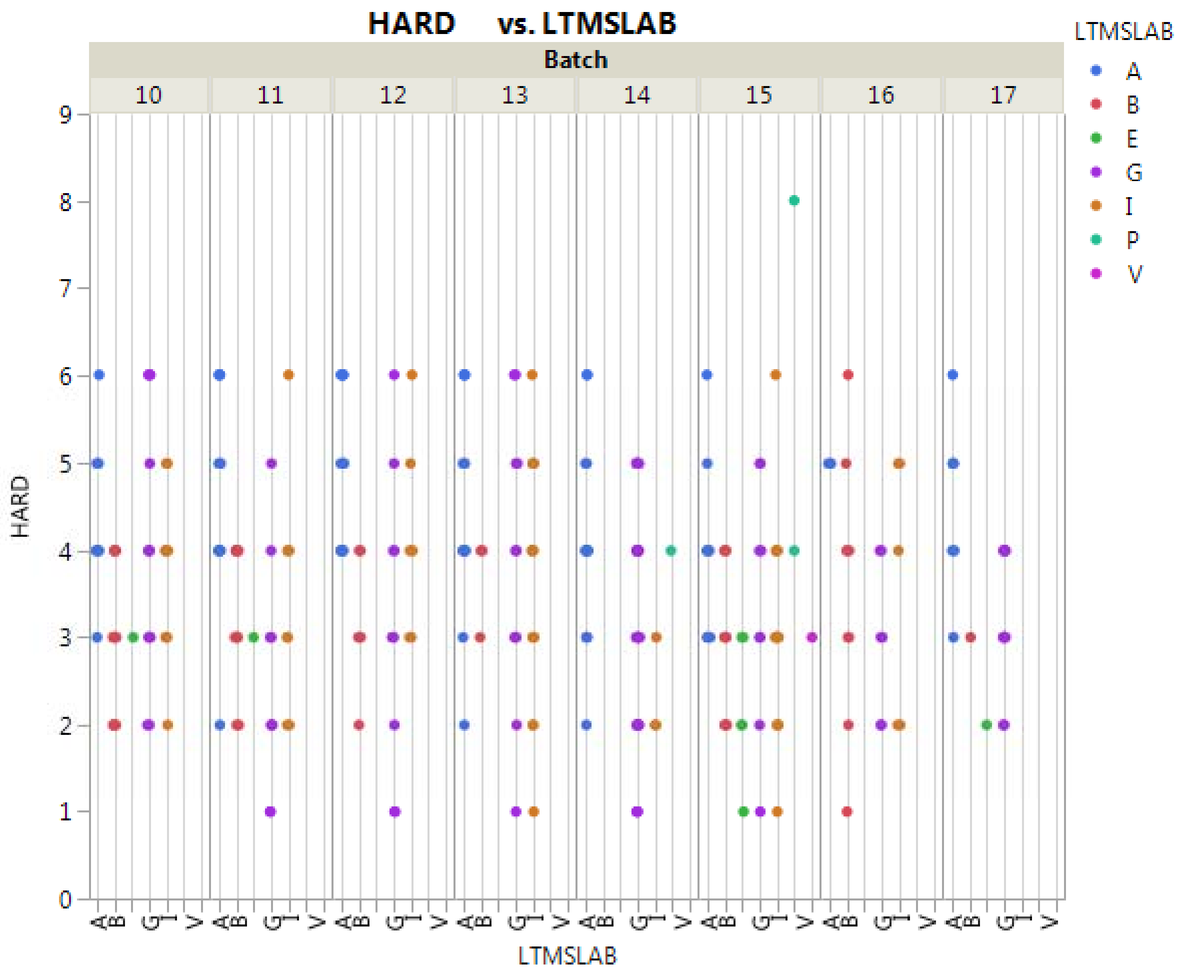
Individual Fluoroelastomer HARD by Batch and Lab (Batches 10 – 17)



For each batch, the results for each lab overlap.

Fluoroelastomer HARD Regression Analysis

- HARD was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

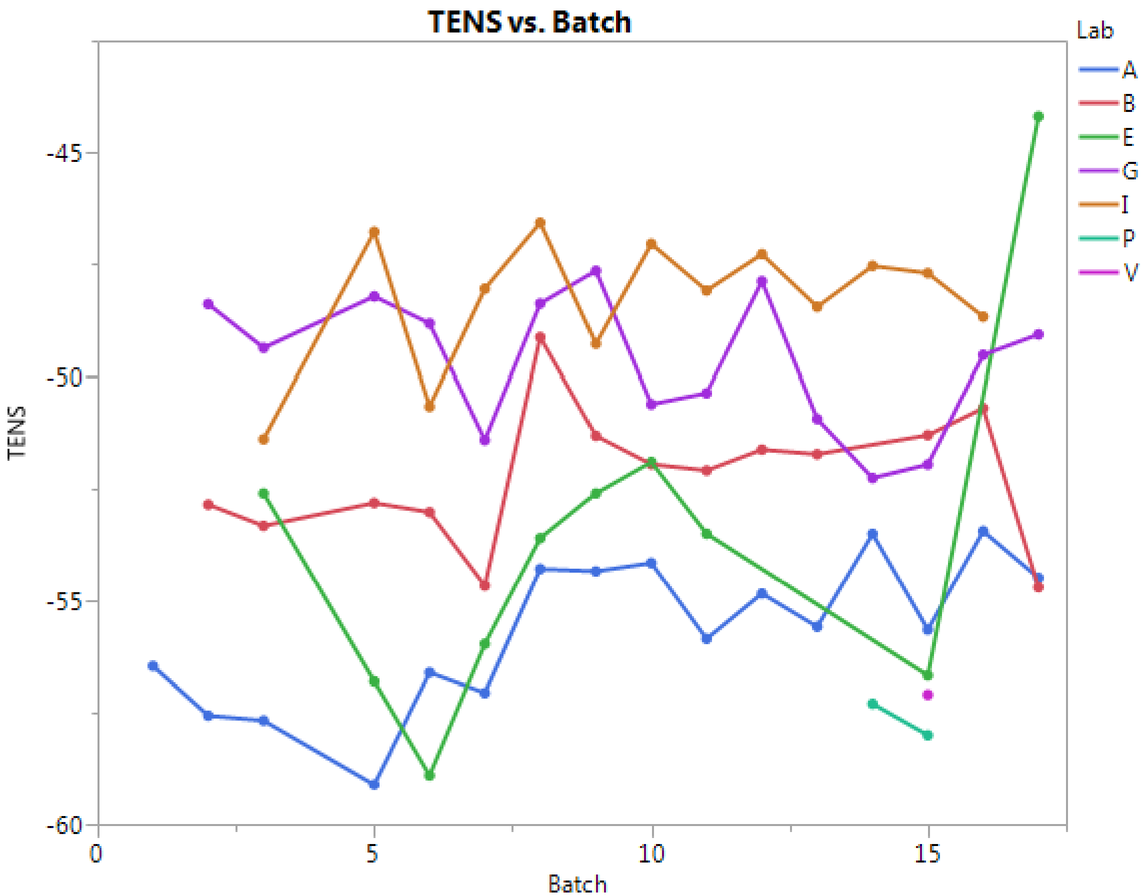
Effect	df	F Ratio	p-Value
Batch	15	1.7286	0.041
LTMSLAB	6	36.3941	<.0001

Lab	Level				LS Mean
P	1				6
A	1				4
I		2			4
B		2	3		3
V	1	2	3	4	3
G				4	3
E			3	4	3

Labs not connected by the same Level (number) are statistically significantly different.

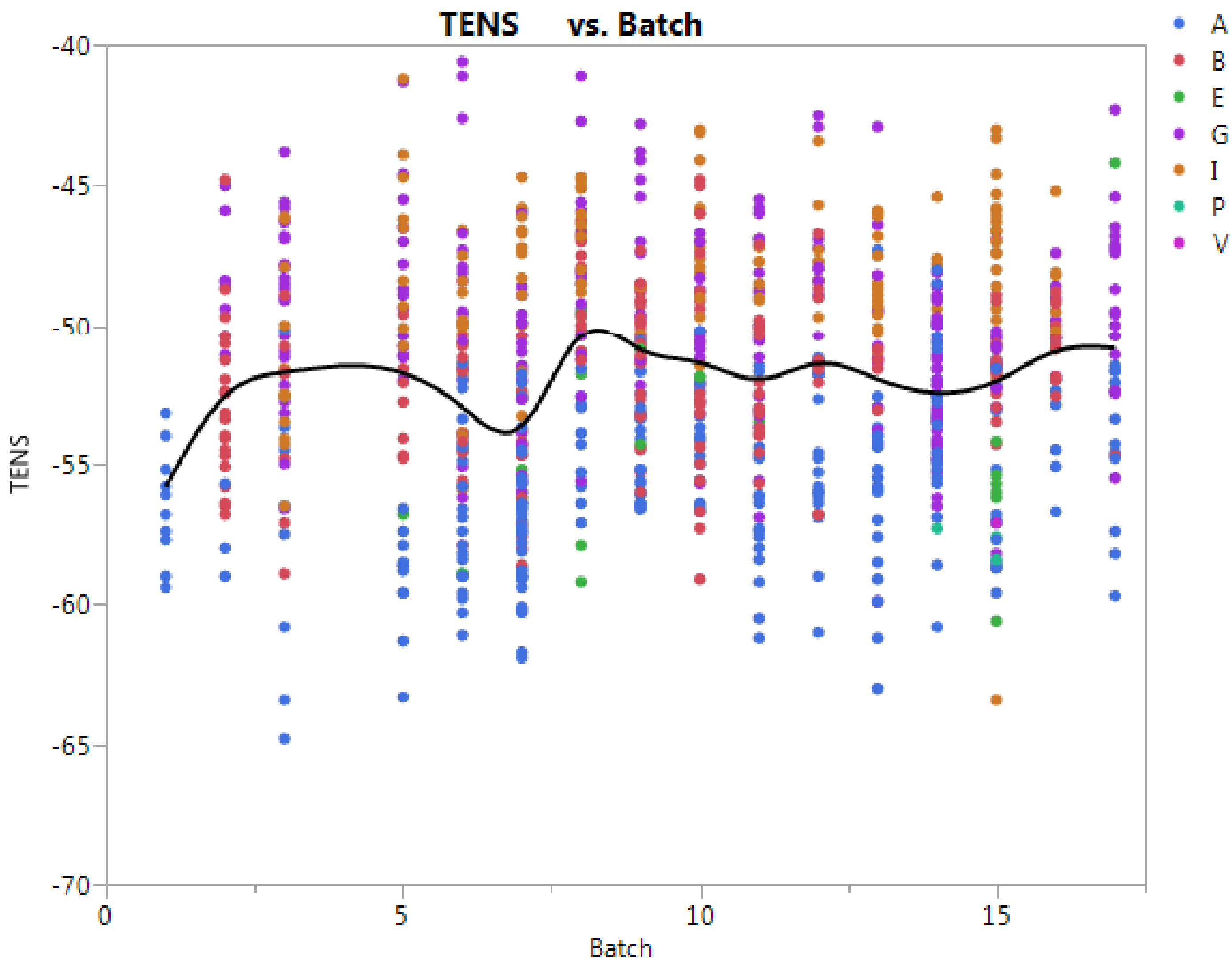
FLUOROELASTOMER TENS

Batch Average Fluoroelastomer TENS by Lab



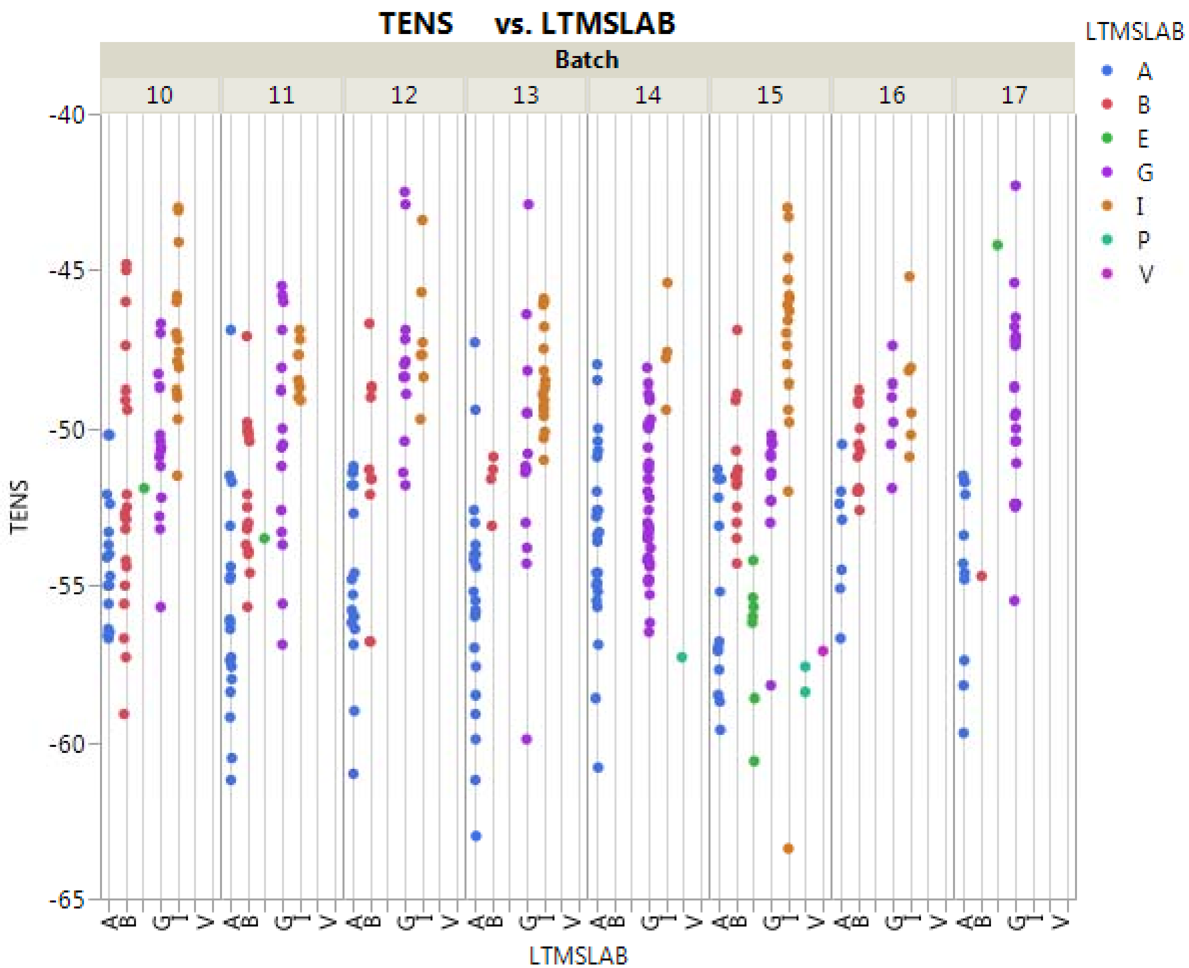
- Labs G and I have the least absolute Tensile Change and Labs A and E have the highest.

Individual Fluoroelastomer TENS by Batch and Lab



Performance you can rely on.

Individual Fluoroelastomer TENS by Batch and Lab (Batches 10 – 17)



In many of the batches, the ranking of labs is consistent but the results overlap.

Performance you can rely on.

Fluoroelastomer TENS Regression Analysis

- TENS was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

Effect	df	F Ratio	p-Value
Batch	15	5.581	<.0001
LTMSLAB	6	112.322	<.0001

Lab	Level				LS Mean
I	1				-48.3
G		2			-49.9
B			3		-52.2
E				4	-54.7
A				4	-55.4
V	1	2	3	4	-56.8
P			3	4	-57.4

Labs not connected by the same Level (number) are statistically significantly different.

NITRILE

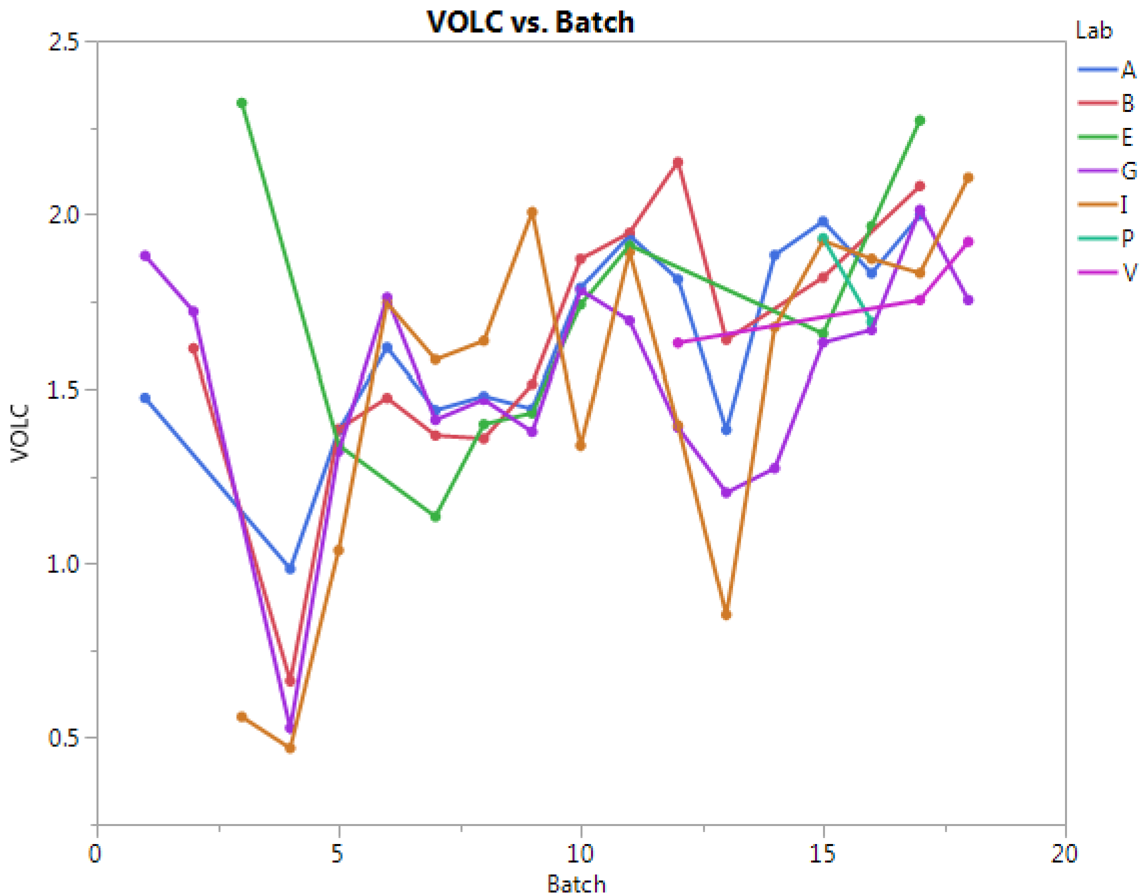
Performance you can rely on.

Nitrile Sample Size

Batch	Sample Size							
	Total	Lab A	Lab B	Lab E	Lab G	Lab I	Lab P	Lab V
1	8	7	0	0	1	0	0	0
2	21	0	12	0	9	0	0	0
3	2	0	0	1	0	1	0	0
4	57	14	16	0	22	5	0	0
5	48	14	8	1	19	6	0	0
6	65	20	6	0	13	26	0	0
7	92	43	16	4	16	13	0	0
8	52	2	16	2	20	12	0	0
9	67	34	14	5	12	2	0	0
10	63	15	13	2	24	9	0	0
11	58	9	23	1	11	14	0	0
12	53	21	7	0	11	13	0	1
13	55	14	17	0	14	10	0	0
14	62	25	0	0	29	8	0	0
15	57	14	20	3	12	7	1	0
16	61	15	0	4	22	18	2	0
17	38	17	5	1	7	1	0	7
18	19	0	0	0	11	7	0	1

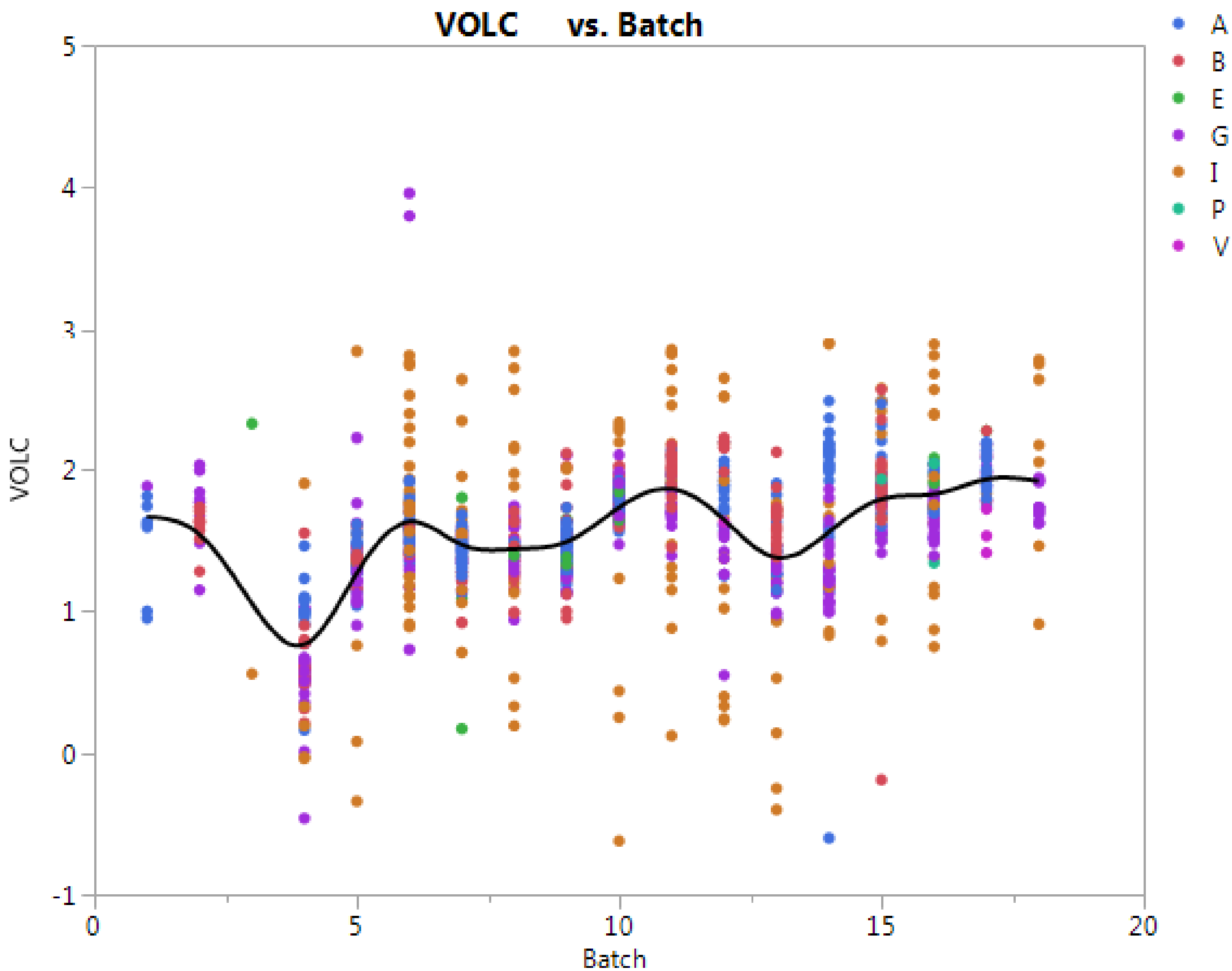
NITRILE VOLC

Batch Average Nitrile VOLC by Lab

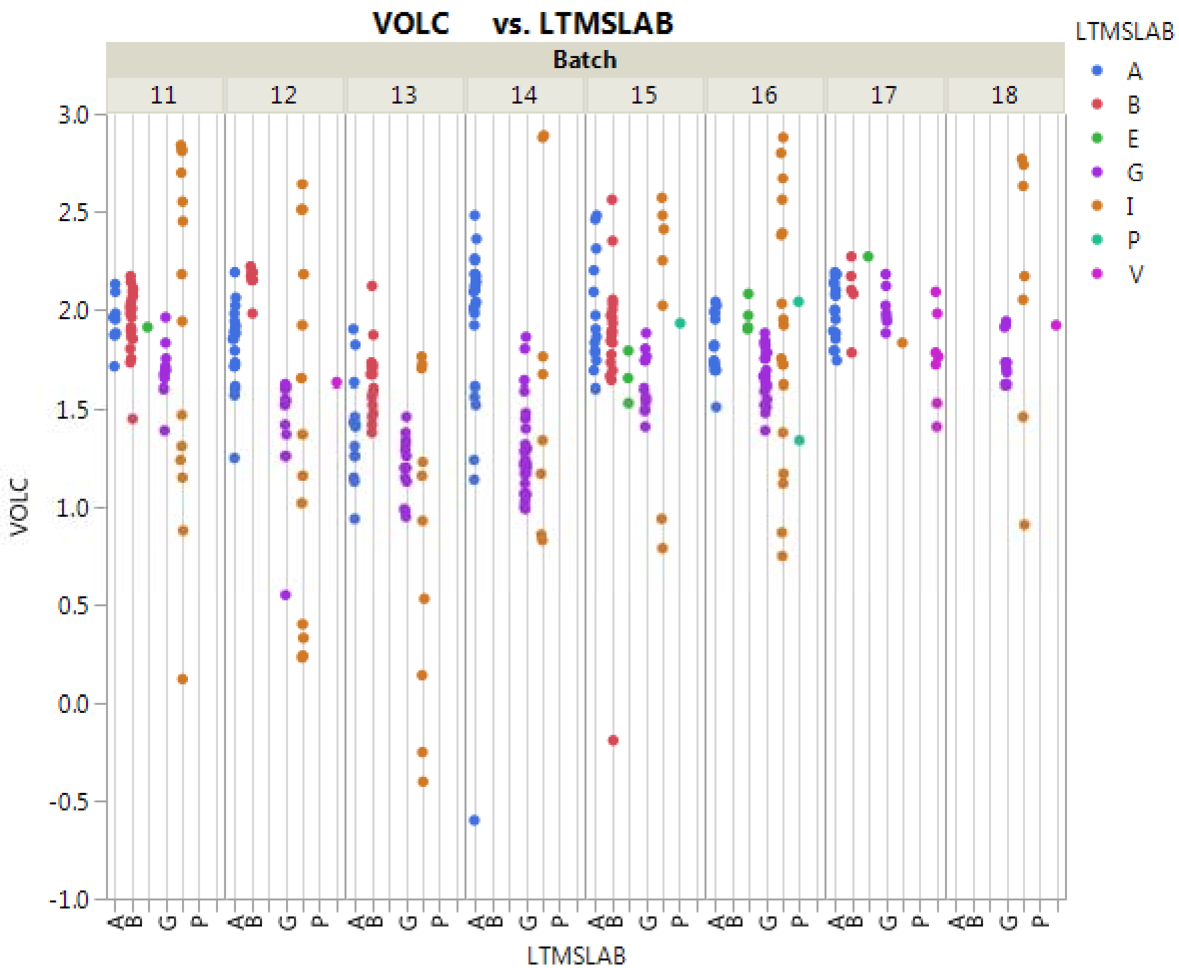


Visually, there are no obvious consistent rankings among the labs across batches.

Individual Nitrile VOLC by Batch and Lab



Individual Nitrile VOLC by Batch and Lab (Batches 11 – 18)



- Generally, the results of the labs overlap within each batch.
- Note that Lab I has wider dispersion of results than the other labs.

Nitrile VOLC Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

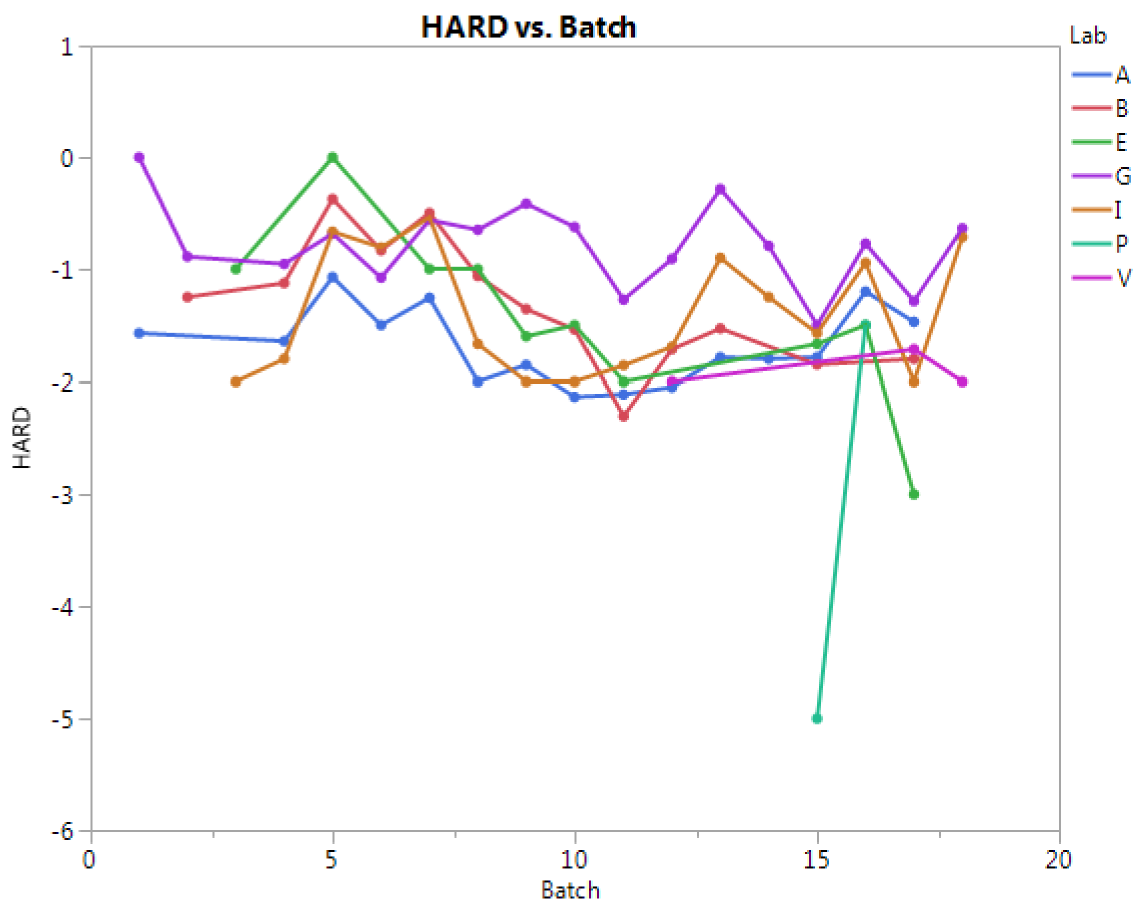
Effect	df	F Ratio	p-Value
Batch	17	25.5146	<.0001
LTMSLAB	6	4.3946	0.0002

Lab	Level		LS Mean
A	1		1.66
B	1		1.63
E	1	2	1.58
I	1	2	1.54
P	1	2	1.53
G		2	1.48
V	1	2	1.39

Labs not connected by the same Level (number) are statistically significantly different.

NITRILE HARD

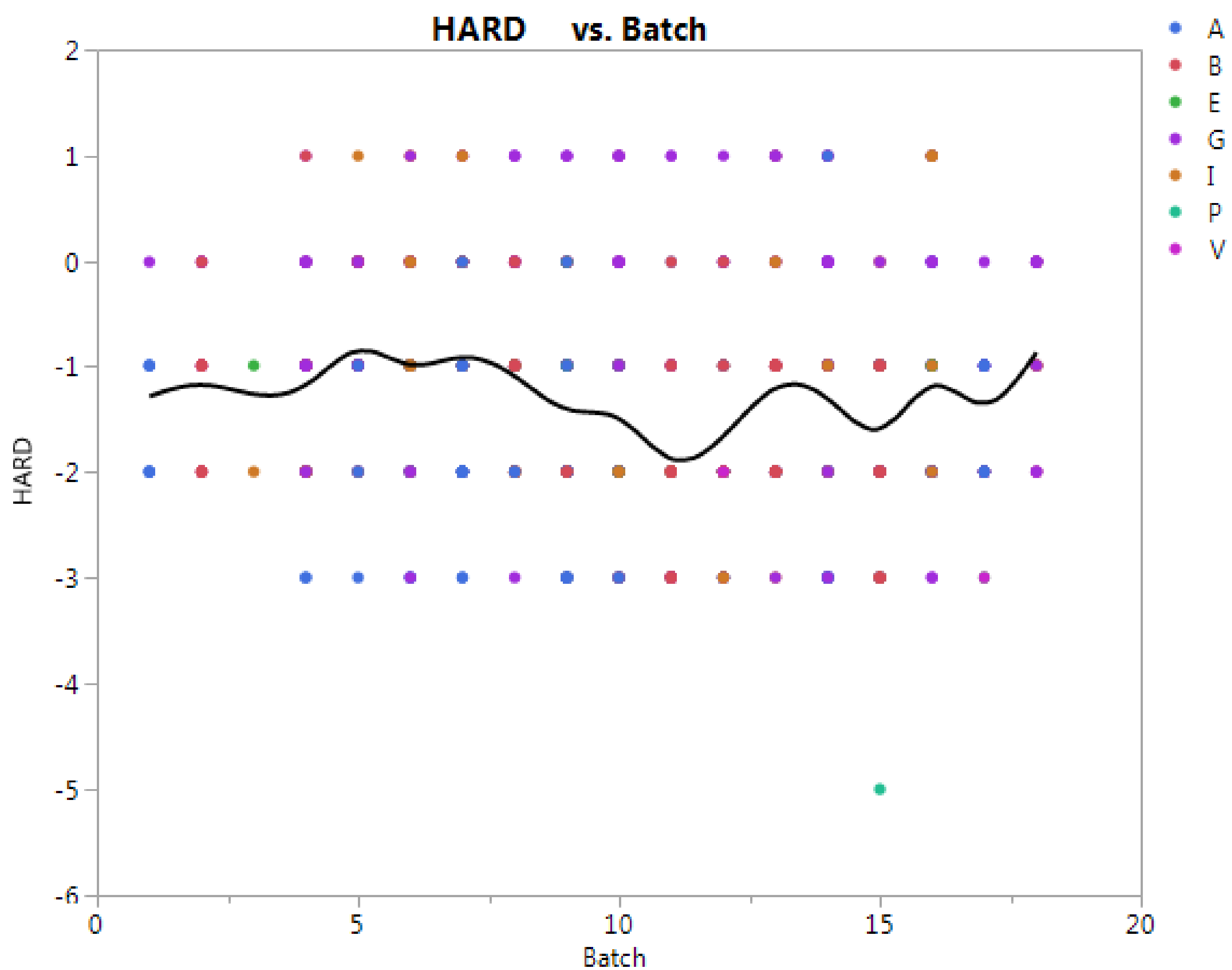
Batch Average Nitrile HARD by Lab



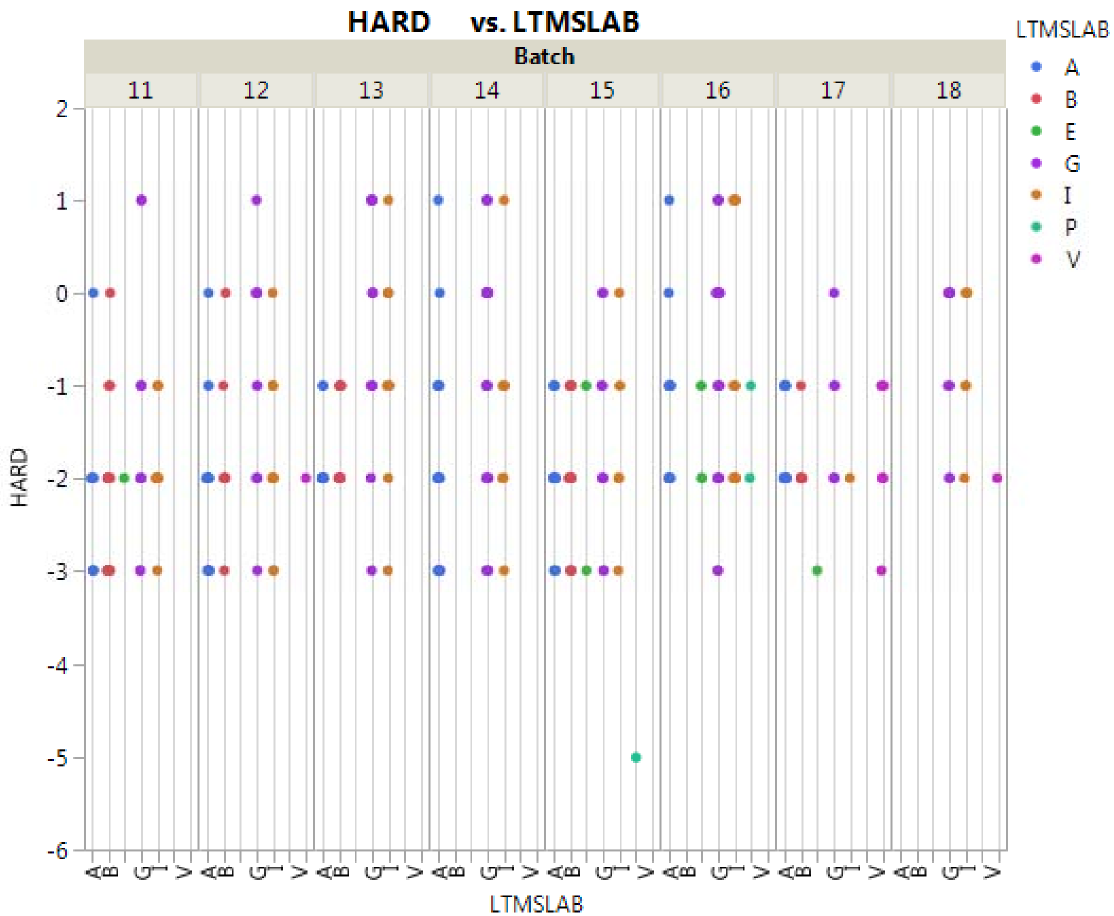
Lab G consistently has among the lowest absolute HARD and Lab A the most.

Performance you can rely on.

Individual Nitrile HARD by Batch and Lab



Individual Nitrile HARD by Batch and Lab (Batches 11 – 18)



Ranges of HARD overlap within each batch for the labs.

Performance you can rely on.

Nitrile HARD Regression Analysis

- HARD was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey’s multiple comparison test.

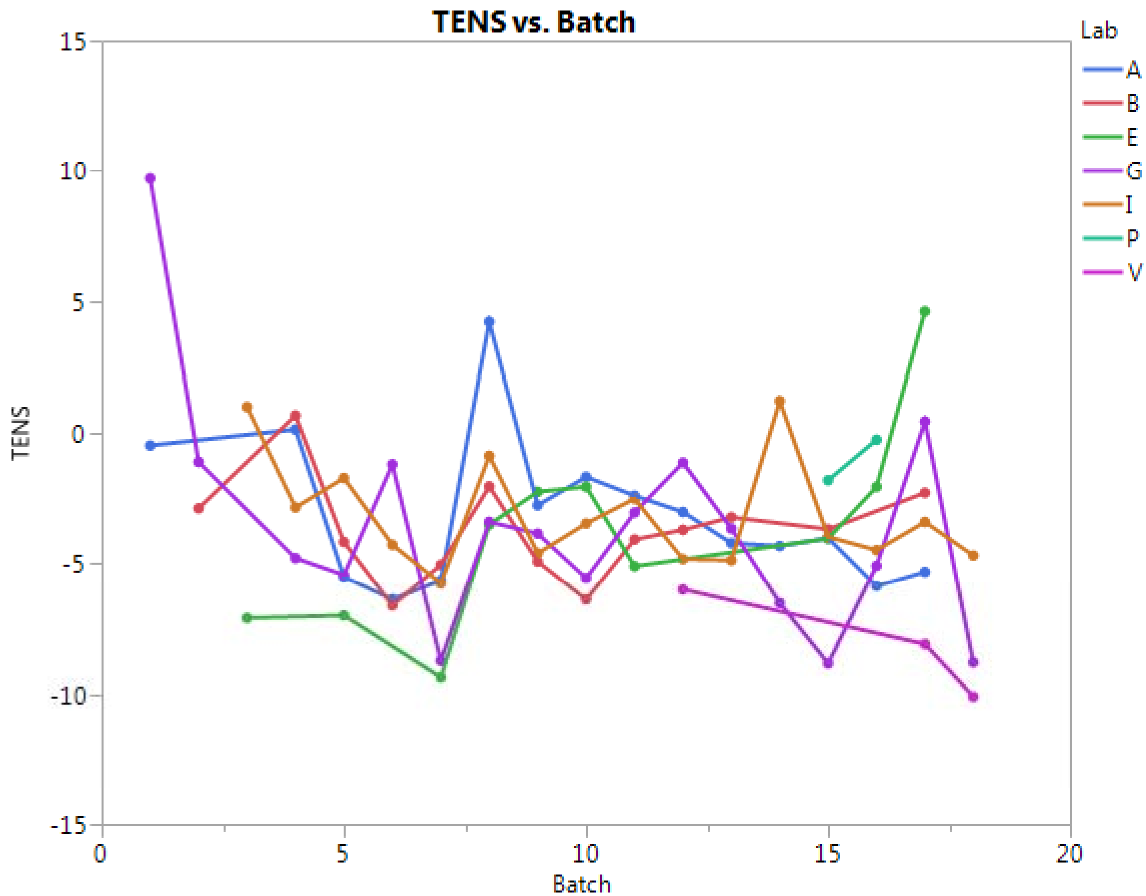
Effect	df	F Ratio	p-Value
Batch	17	6.5744	<.0001
LTMSLAB	6	19.3633	<.0001

Lab	Level			LS Mean
G	1			-1
I		2		-1
B		2		-1
E		2	3	-1
V	1	2	3	-2
A			3	-2
P		2	3	-3

Labs not connected by the same Level (number) are statistically significantly different.

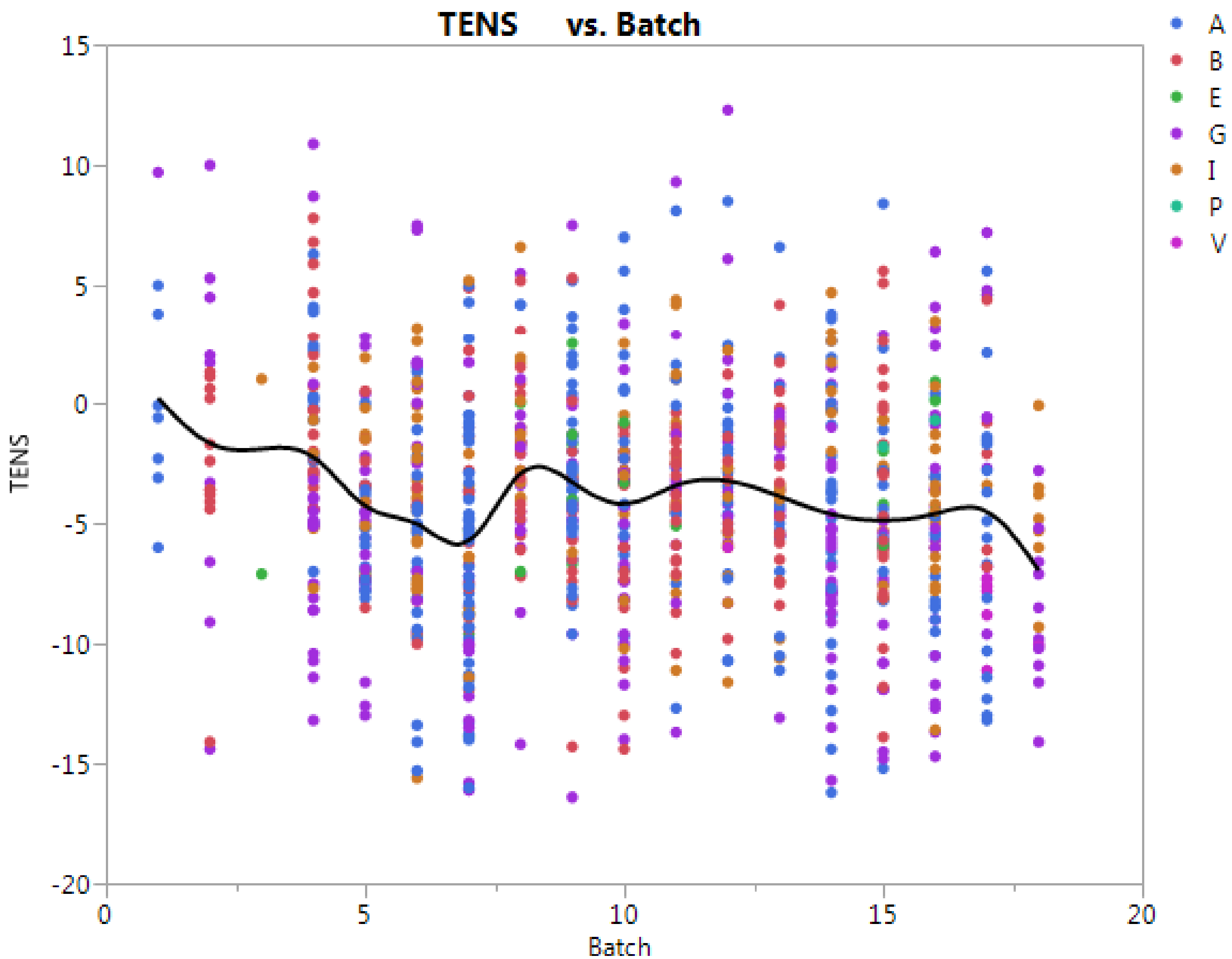
NITRILE TENS

Batch Average Nitrile TENS by Lab



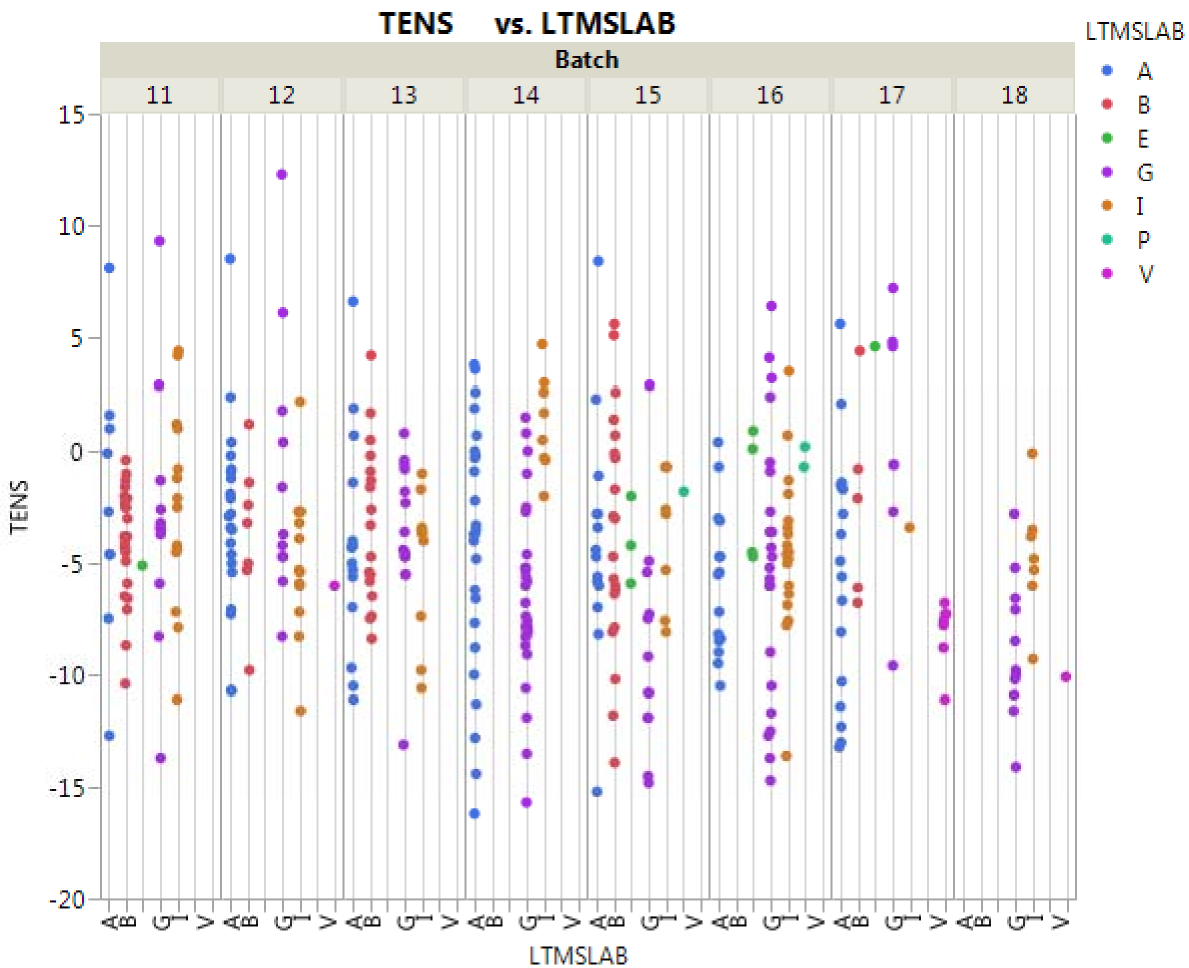
Visually, there are no obvious consistent rankings among the labs across batches.

Individual Nitrile TENS by Batch and Lab



Performance you can rely on.

Individual Nitrile TENS by Batch and Lab (Batches 11 – 18)



Ranges of TENS overlap within each batch for the labs

Nitrile TENS Regression Analysis

- TENS was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

Effect	df	F Ratio	p-Value
Batch	17	4.6924	<.0001
LTMSLAB	6	3.4642	0.0022

Lab	Level		LS Mean
P	1	2	0.4
I	1		-3.0
E	1	2	-3.3
A	1	2	-3.5
B	1	2	-3.6
G		2	-4.5
V		2	-8.2

Labs not connected by the same Level (number) are statistically significantly different.

POLYACRYLATE

Performance you can rely on.

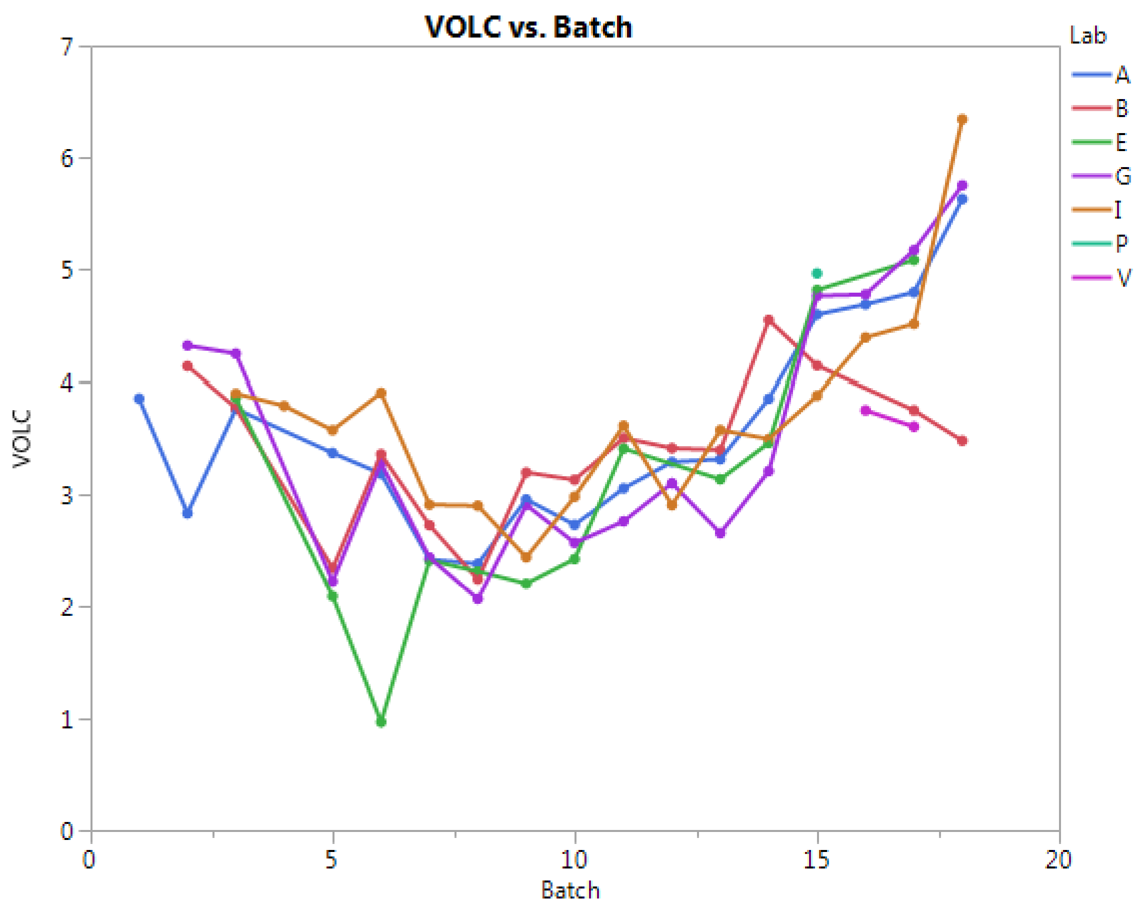
Infineum

Polyacrylate Sample Size

Batch	Sample Size							
	Total	Lab A	Lab B	Lab E	Lab G	Lab I	Lab P	Lab V
1	10	10	0	0	0	0	0	0
2	31	4	18	0	9	0	0	0
3	43	5	9	1	22	6	0	0
4	1	0	0	0	0	1	0	0
5	49	13	10	1	20	5	0	0
6	65	28	4	1	7	25	0	0
7	91	38	18	3	20	12	0	0
8	68	15	16	2	18	17	0	0
9	63	25	19	5	12	2	0	0
10	69	14	18	2	26	9	0	0
11	64	10	23	1	14	16	0	0
12	51	23	6	0	15	7	0	0
13	62	24	11	3	14	10	0	0
14	79	26	2	3	30	18	0	0
15	55	9	17	6	9	11	3	0
16	65	25	0	0	27	12	0	1
17	33	5	9	1	15	1	0	2
18	13	3	1	0	6	3	0	0

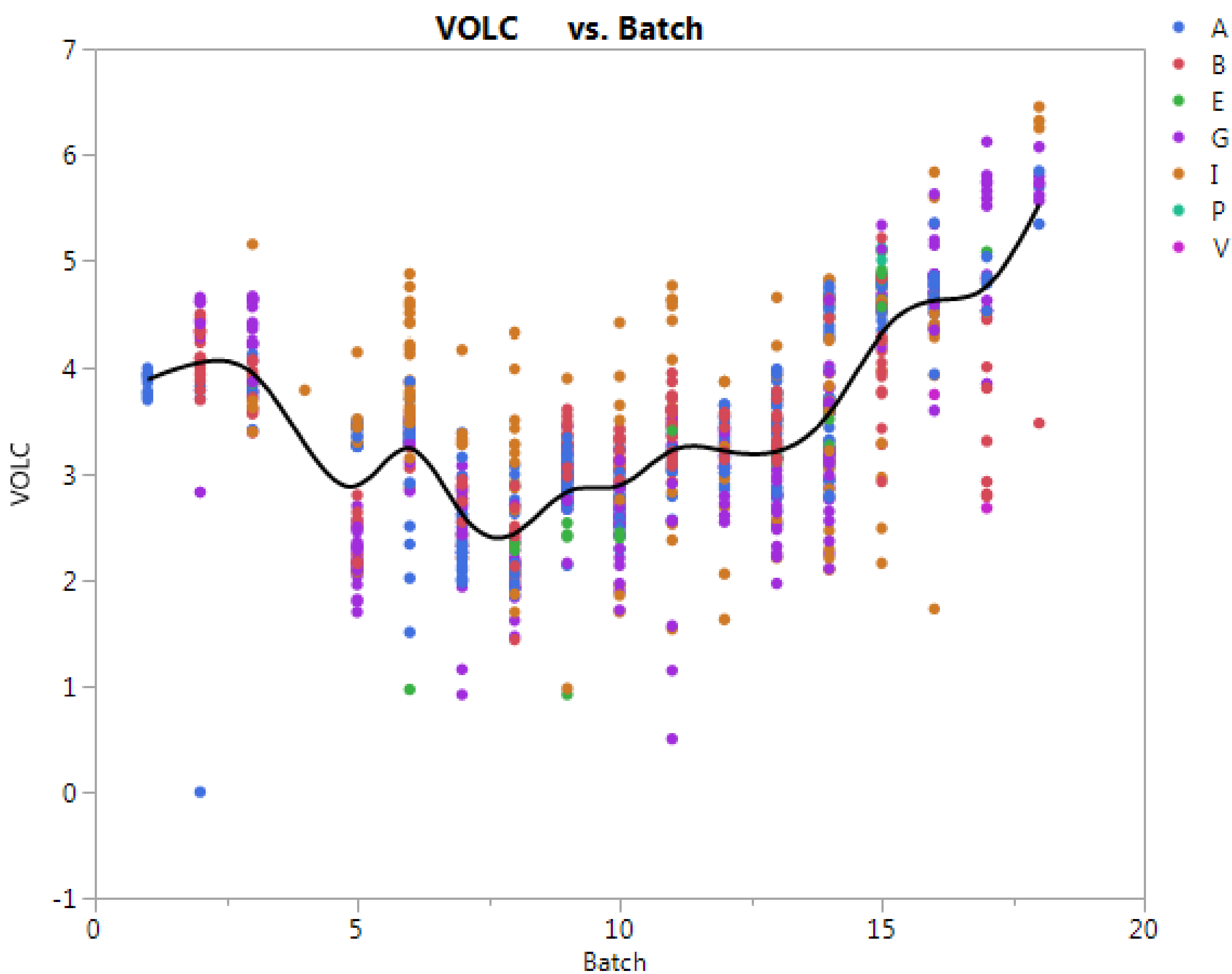
POLYACRYLATE VOLC

Batch Average Polyacrylate VOLC by Lab



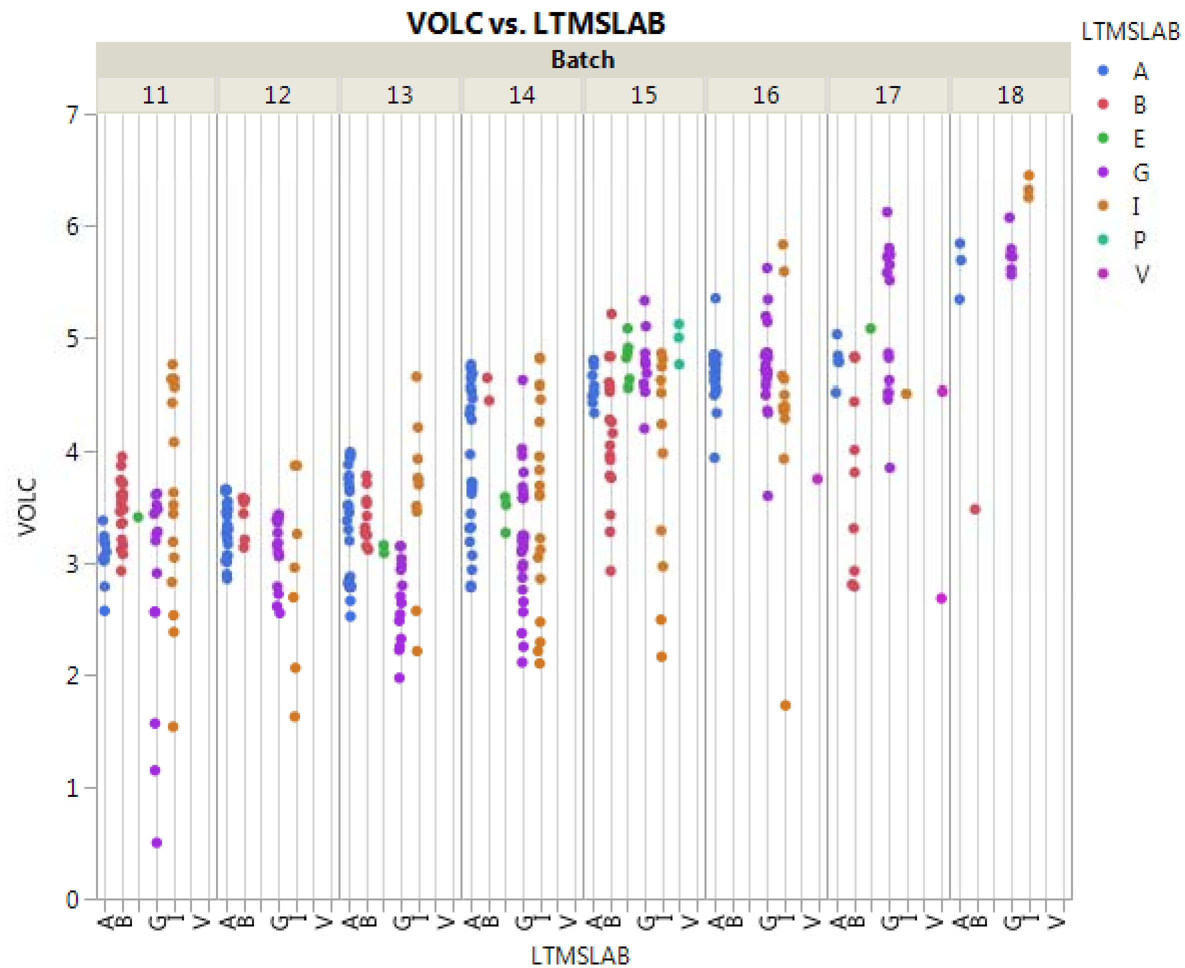
Visually, there are no obvious consistent rankings by lab.

Individual Polyacrylate VOLC by Batch and Lab



Performance you can rely on.

Individual Polyacrylate VOLC by Batch and Lab (Batches 11 – 18)



Most of the batches exhibit a high degree of overlap among the labs with no obvious consistent ordering among the labs.

Polyacrylate VOLC Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

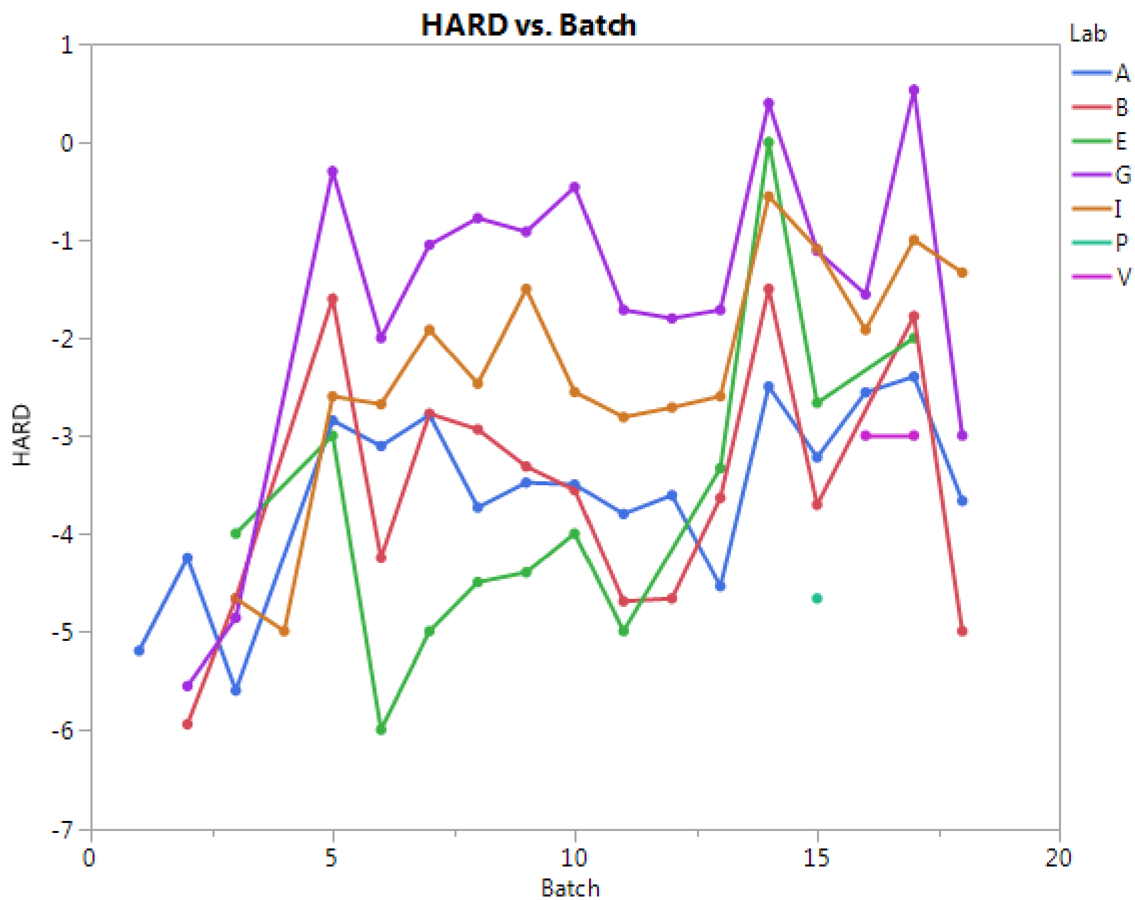
Effect	df	F Ratio	p-Value
Batch	17	84.4016	<.0001
LTMSLAB	6	6.6666	<.0001

Lab	Level			LS Mean
P	1	2		4.23
I	1			3.80
B	1	2		3.63
A	1	2		3.63
G		2	3	3.49
E		2	3	3.42
V			3	2.56

Labs not connected by the same Level (number) are statistically significantly different.

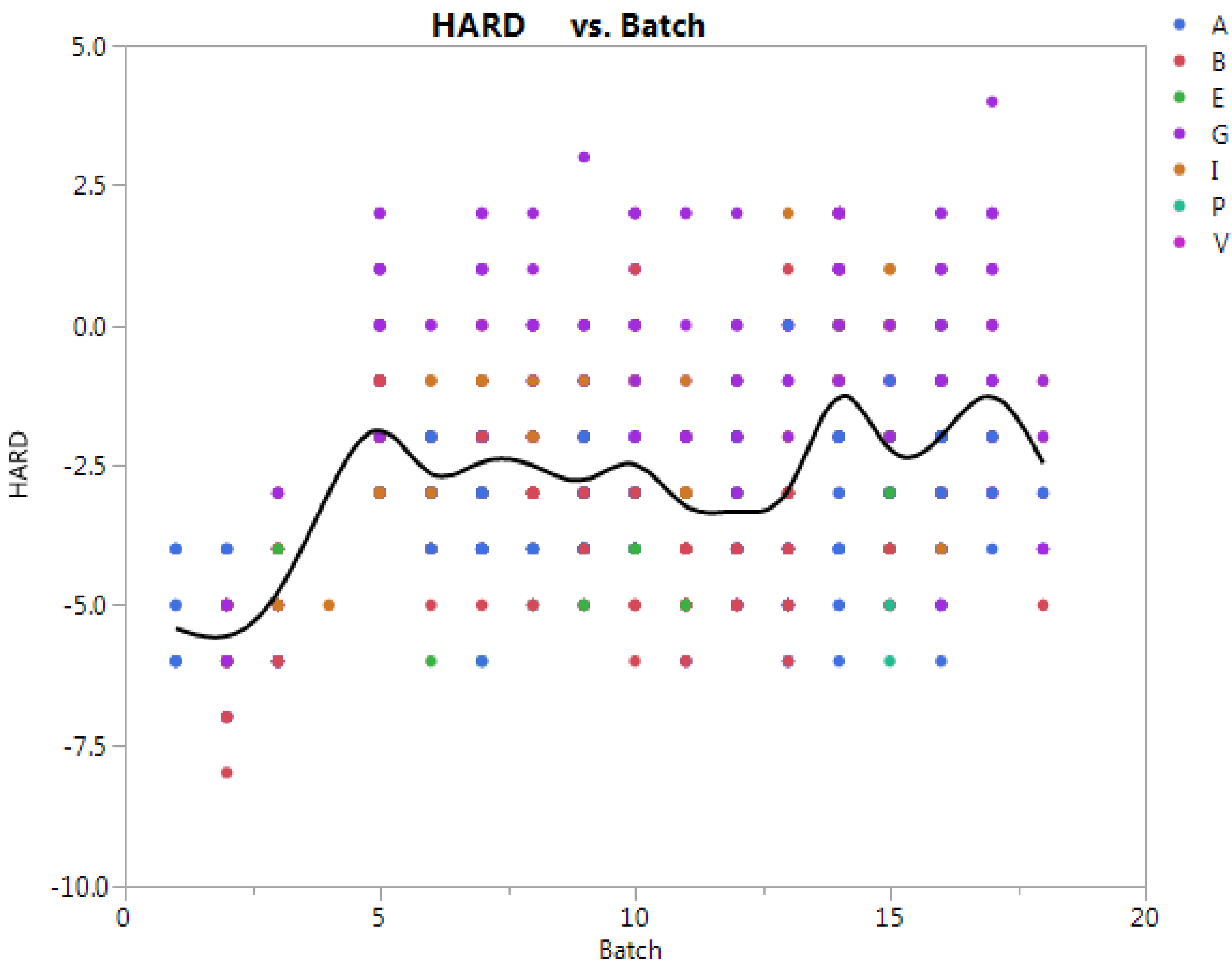
POLYACRYLATE HARD

Batch Average Polyacrylate HARD by Lab



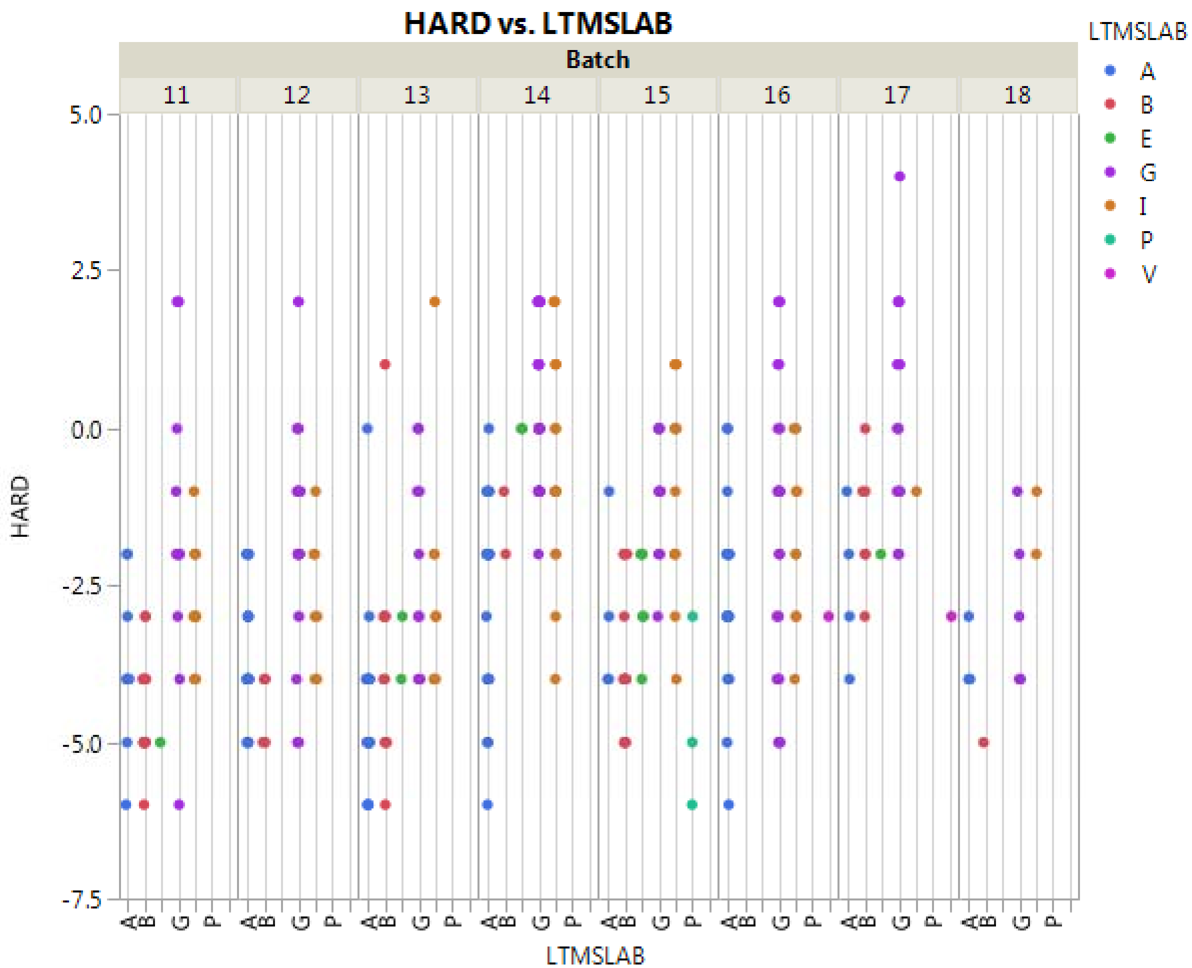
- Labs G and I consistently have among the lowest absolute HARD and Labs A, B and E among the highest.

Individual Polyacrylate HARD by Batch and Lab



Performance you can rely on.

Individual Polyacrylate HARD by Batch and Lab (Batches 11 – 18)



In general, Labs G and I exhibit lower absolute HARD than A and B.

Polyacrylate HARD Regression Analysis

- HARD was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table indicates which labs differ based on Tukey's multiple comparison test.

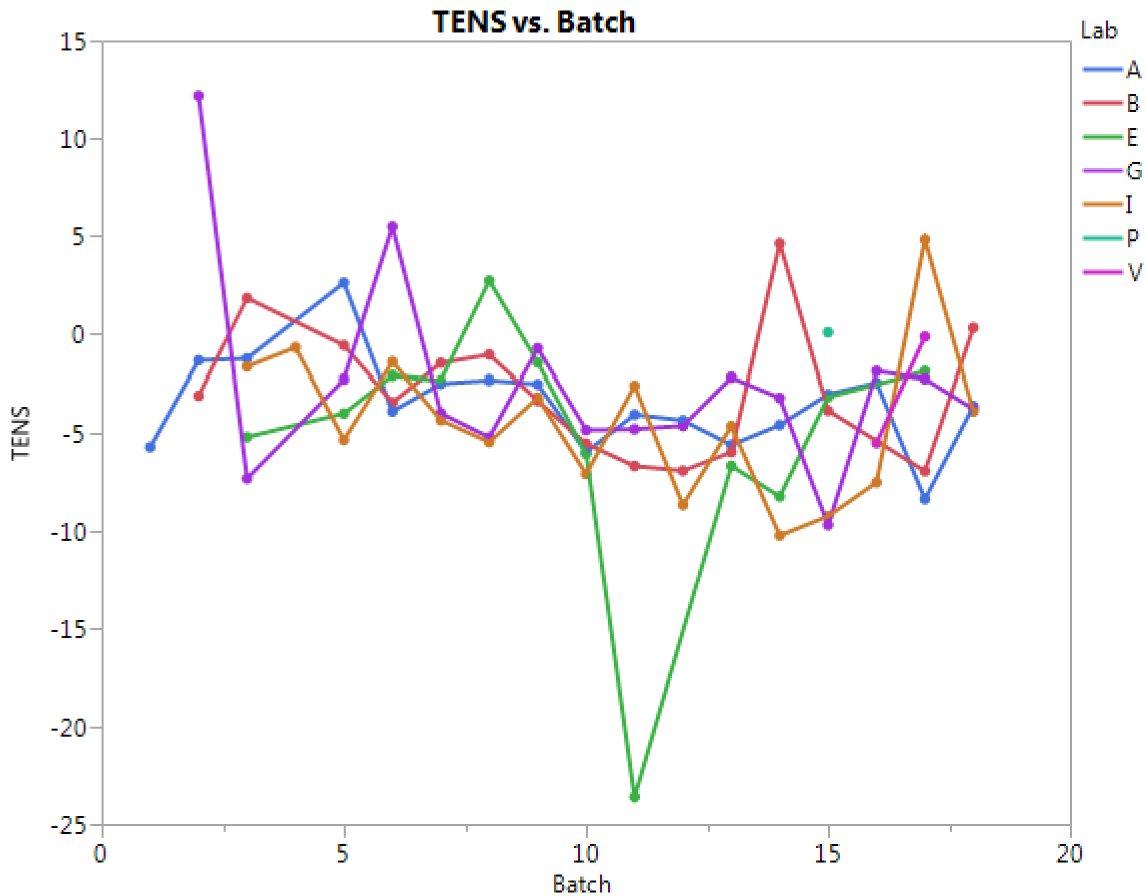
Effect	df	F Ratio	p-Value
Batch	17	32.815	<.0001
LTMSLAB	6	66.5328	<.0001

Lab	Level			LS Mean
G	1			-2
I		2		-3
B			3	-4
A			3	-4
E			3	-4
V		2	3	-5
P			3	-5

Labs not connected by the same Level (number) are statistically significantly different.

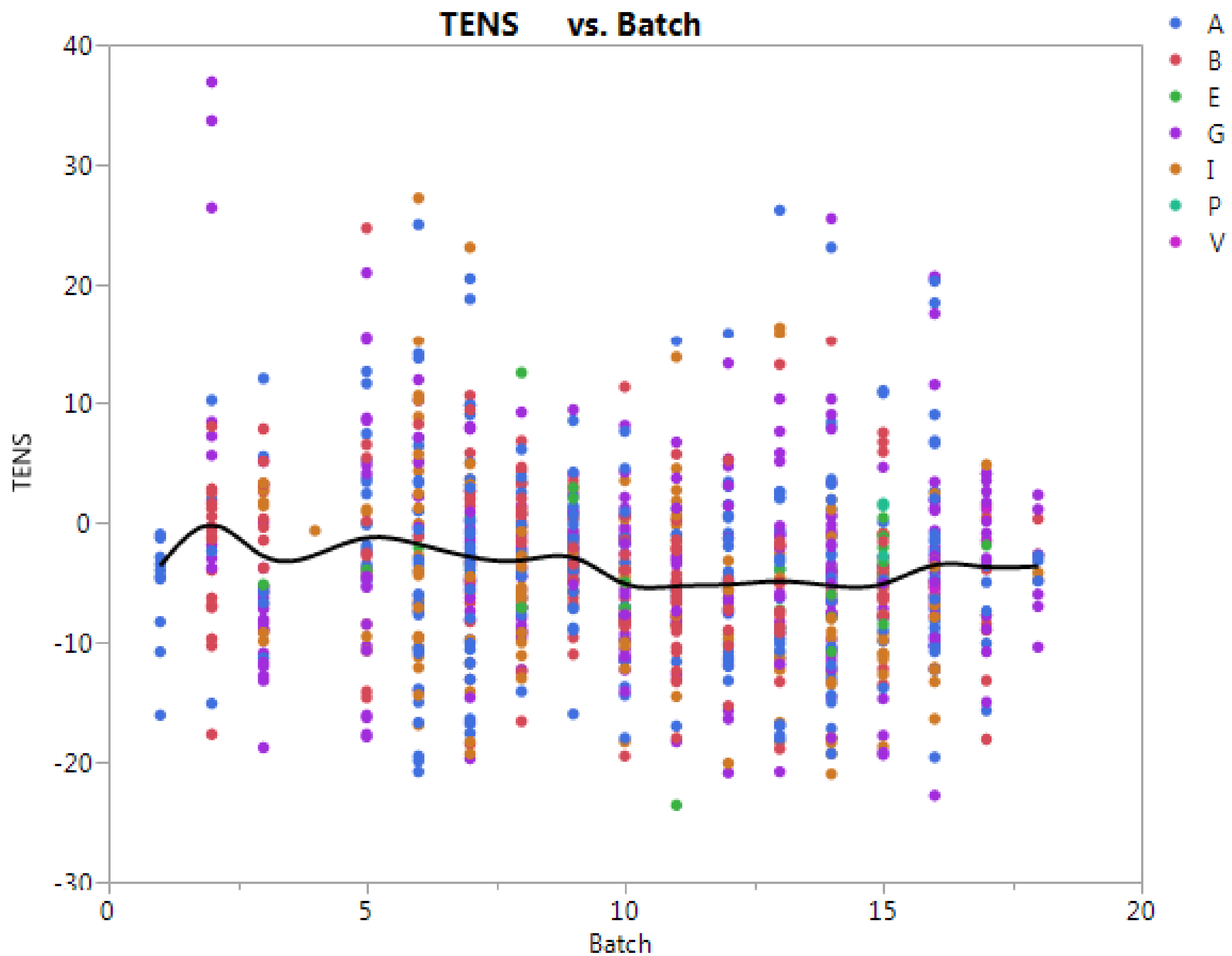
POLYACRYLATE TENS

Batch Average Polyacrylate TENS by Lab



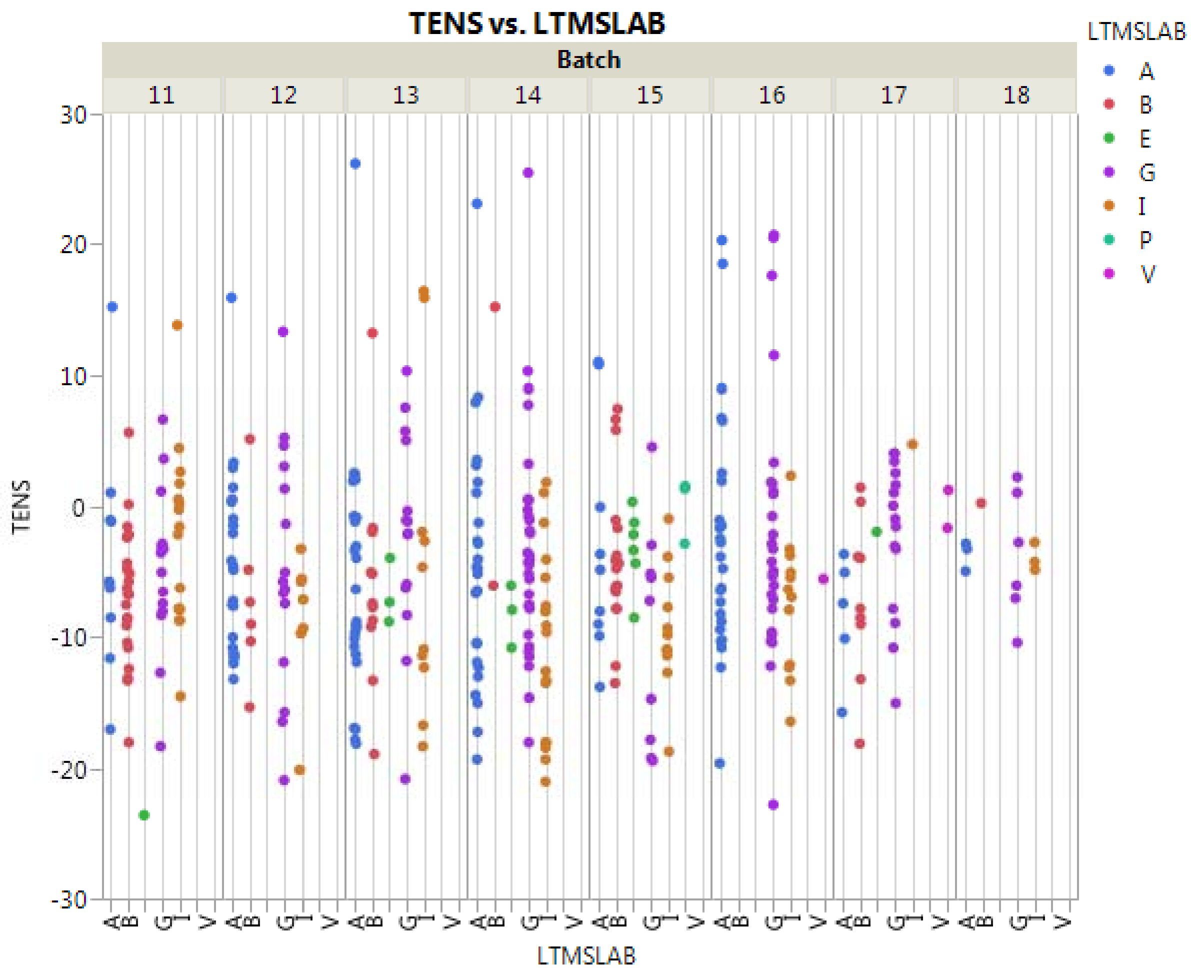
Visually, there are no obvious consistent rankings by lab.

Individual Polyacrylate TENS by Batch and Lab



Performance you can rely on.

Individual Polyacrylate TENS by Batch and Lab (Batches 11 – 18)



Each of the batches exhibit a high degree of overlap among the labs with no obvious consistent ordering among the labs.

Polyacrylate TENS Regression Analysis

- TENS was regressed on Batch and Lab.
  - Batch effect is strongly statistically significant.
  - Lab effect is not statistically significant.
- The bottom table orders the labs by their LS Mean though they are not statistically significantly different.

Effect	df	F Ratio	p-Value
Batch	17	2.4606	0.0009
LTMSLAB	6	1.5016	0.1745

Lab	Level	LS Mean
P	1	2.2
V	1	-1.3
G	1	-2.8
A	1	-3.2
B	1	-3.5
E	1	-3.5
I	1	-4.9

Labs not connected by the same Level (number) are statistically significantly different.

SILICONE

Performance you can rely on.

Infineum Confidential Information.

Silicone Data

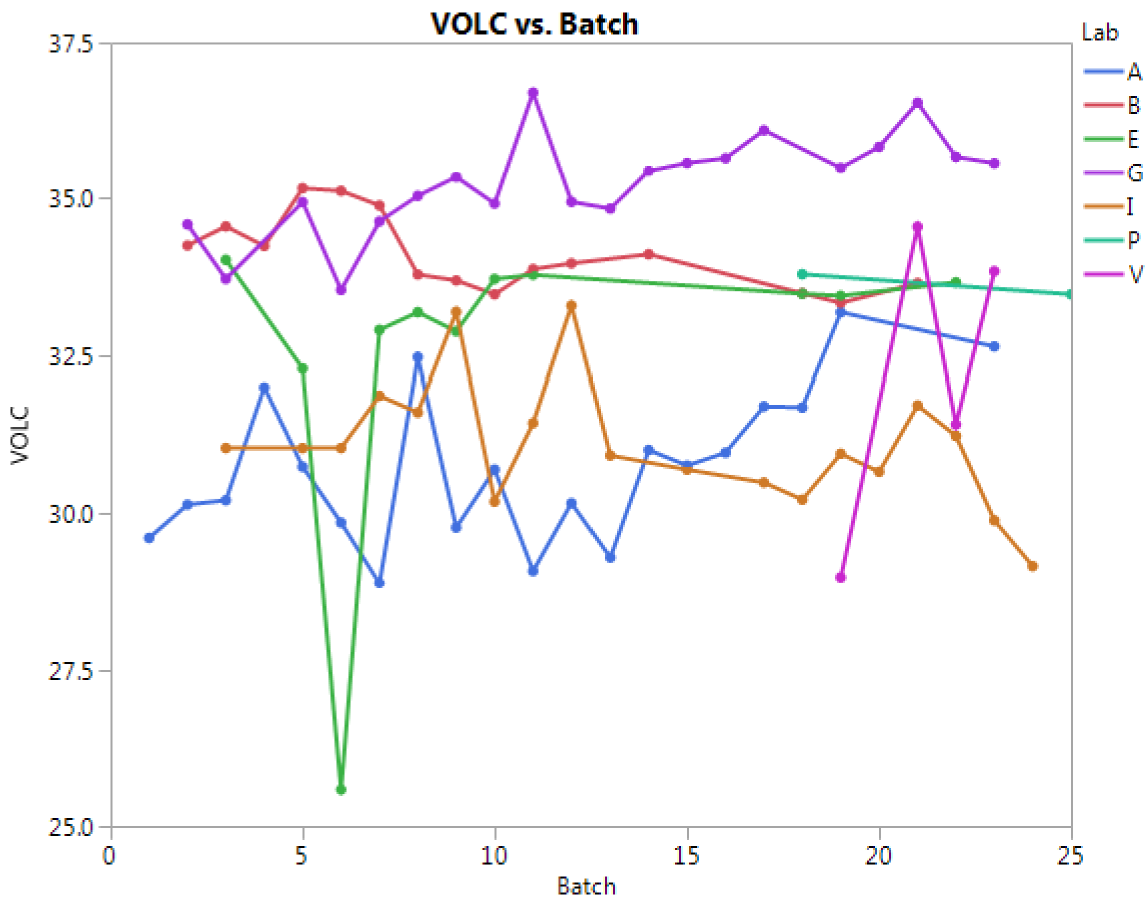
- Testkey 74794 had VOLC = -52.67 – this result was excluded from all plots, calculations and analyses.

Silicone Sample Size

Batch	Sample Size							
	Total	Lab A	Lab B	Lab E	Lab G	Lab I	Lab P	Lab V
1	12	12	0	0	0	0	0	0
2	33	4	19	0	10	0	0	0
3	36	5	7	1	14	8	0	0
4	6	5	1	0	0	0	0	0
5	47	13	7	1	15	11	0	0
6	87	47	5	2	14	19	0	0
7	71	19	16	3	19	14	0	0
8	49	2	16	2	13	16	0	0
9	70	31	15	5	17	2	0	0
10	70	18	19	2	22	9	0	0
11	53	4	22	1	10	16	0	0
12	30	8	11	0	6	5	0	0
13	33	13	0	0	12	8	0	0
14	25	18	5	0	2	0	0	0
15	30	10	0	0	10	10	0	0
16	36	18	0	0	18	0	0	0
17	54	15	0	0	29	10	0	0
18	28	2	14	3	0	7	2	0
19	59	39	3	4	10	2	0	1
20	18	0	0	0	11	7	0	0
21	28	0	9	0	7	8	0	4
22	34	0	0	1	20	10	0	3
23	39	7	0	0	20	5	0	7
24	3	0	0	0	0	3	0	0
25	2	0	0	0	0	0	2	0

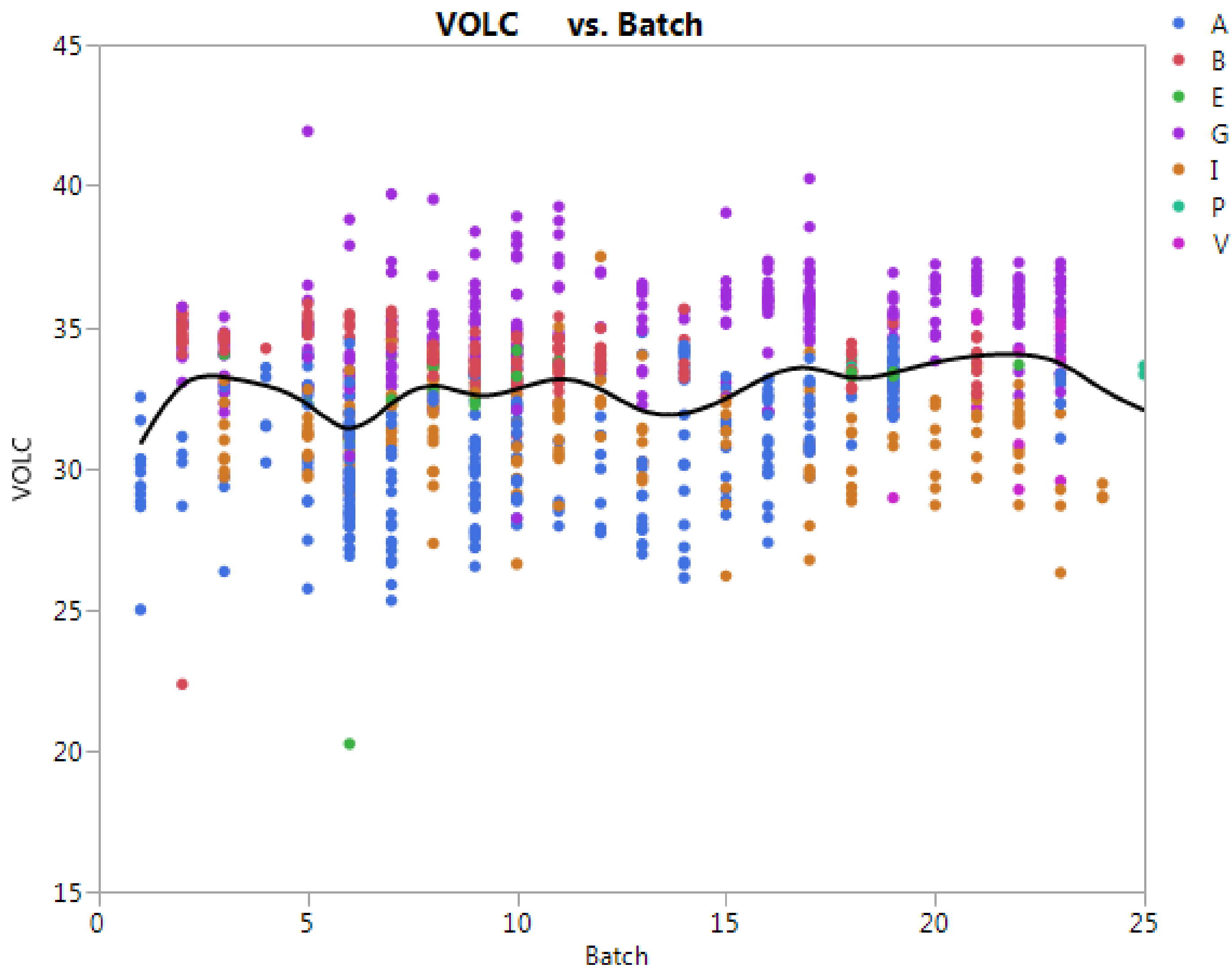
SILICONE VOLC

Batch Average Silicone VOLC by Lab



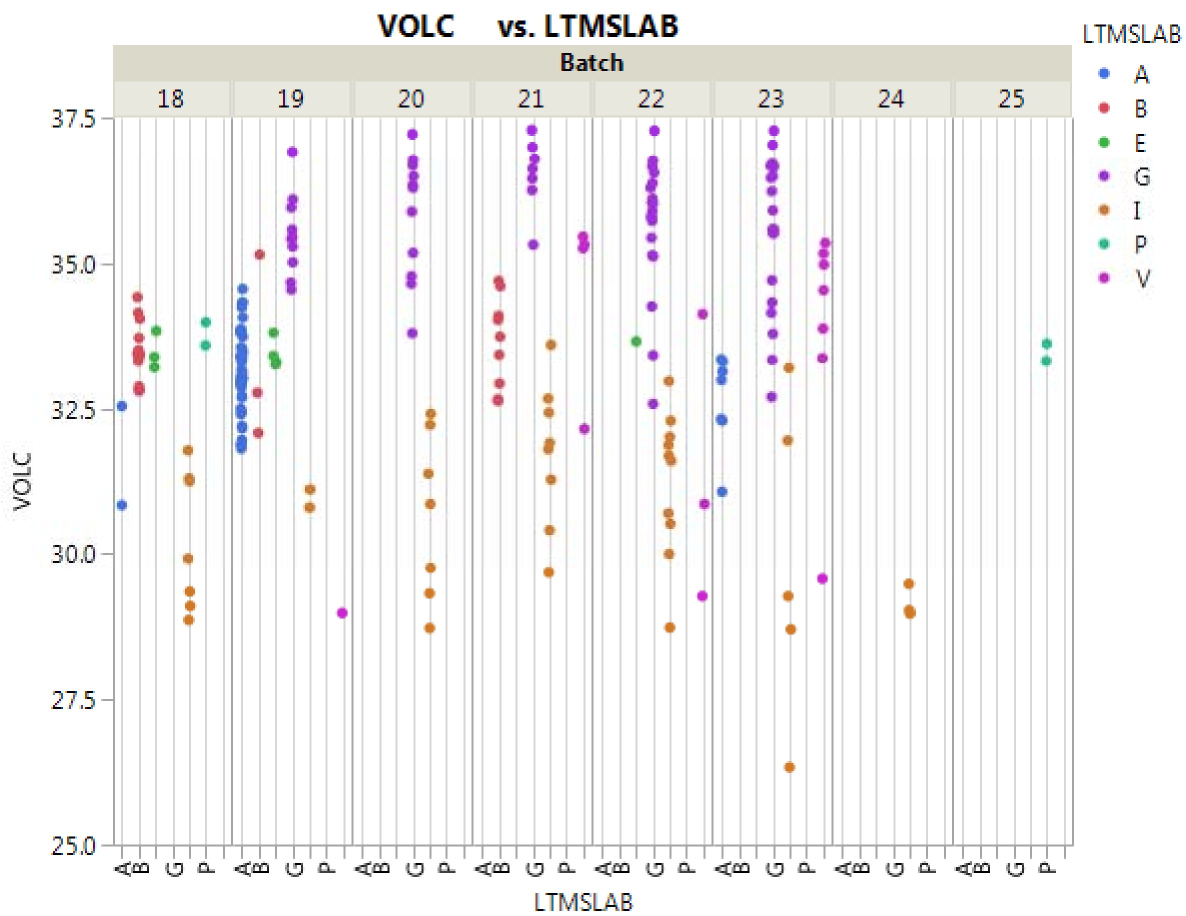
For each batch, Lab G has among the highest VOLC and Labs A and I among the lowest.

Individual Silicone VOLC by Batch and Lab



Performance you can rely on.

Individual Silicone VOLC by Batch and Lab (Batches 18 – 25)



For many of the batches there is lack of lab overlap.

Silicone VOLC Regression Analysis

- VOLC was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table orders the labs by their LS Mean though they are not statistically significantly different.

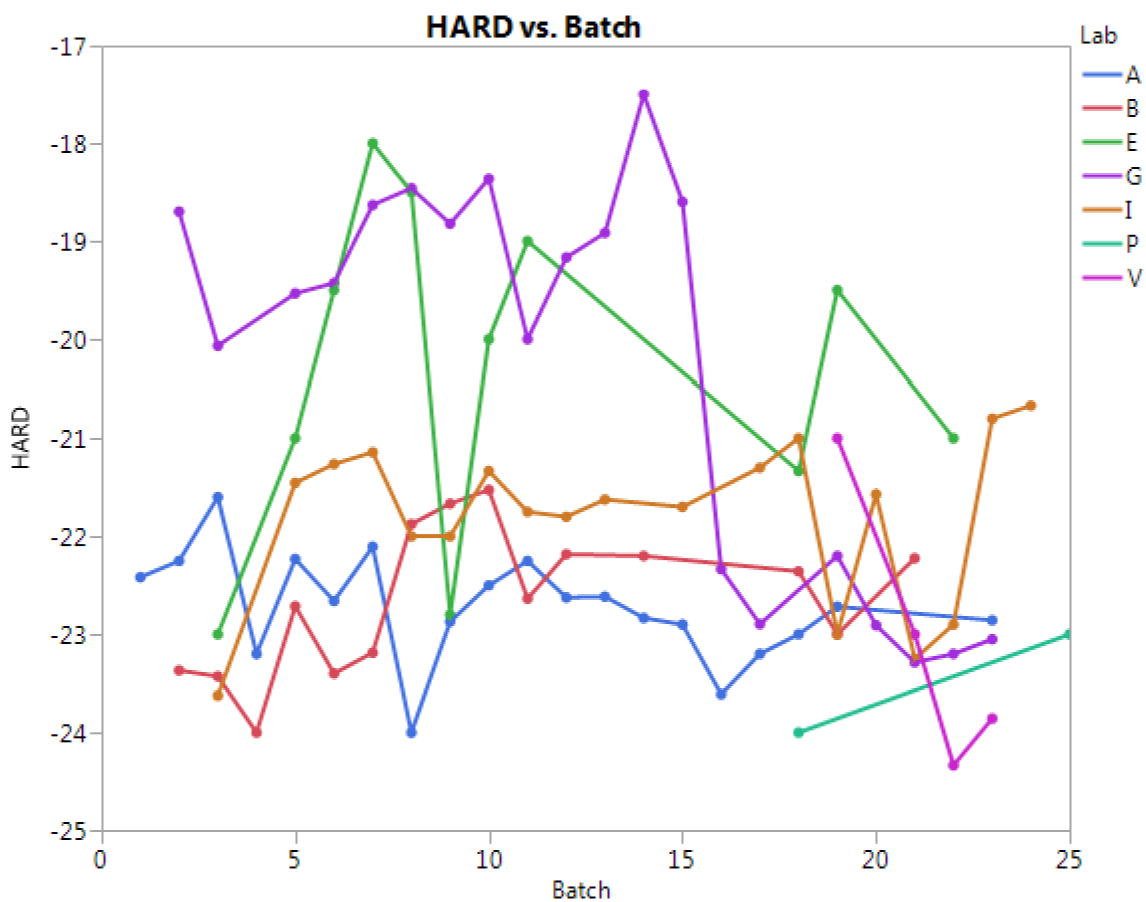
Effect	df	F Ratio	p-Value
Batch	17	5.0318	<.0001
LTMSLAB	6	174.3097	<.0001

Lab	Level					LS Mean
G	1					35.11
P	1	2	3	4	5	34.16
B		2				34.05
E			3			32.57
V		2	3	4		32.56
I				4		31.16
A					5	30.61

Labs not connected by the same Level (number) are statistically significantly different.

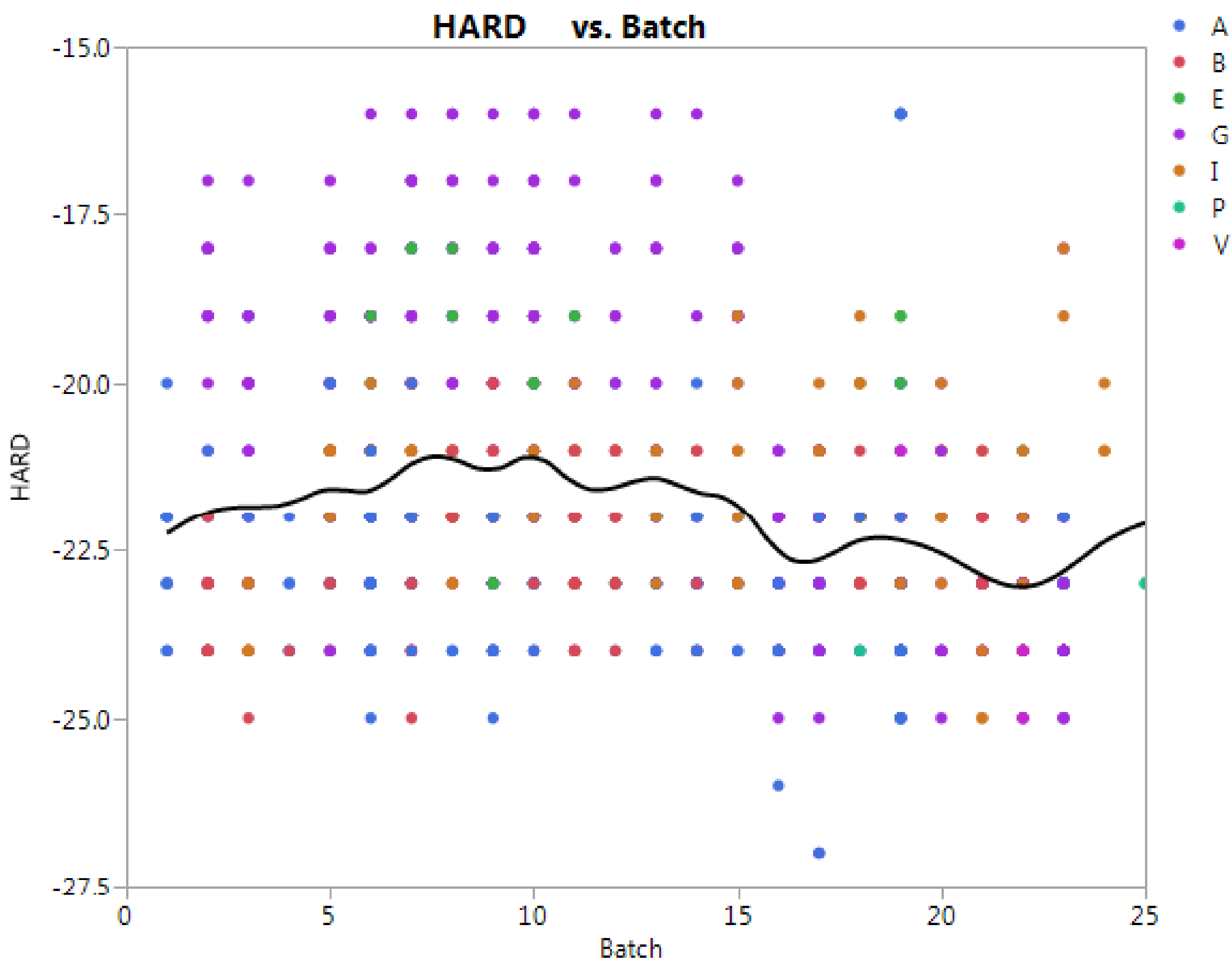
SILICONE HARD

Batch Average Silicone HARD by Lab

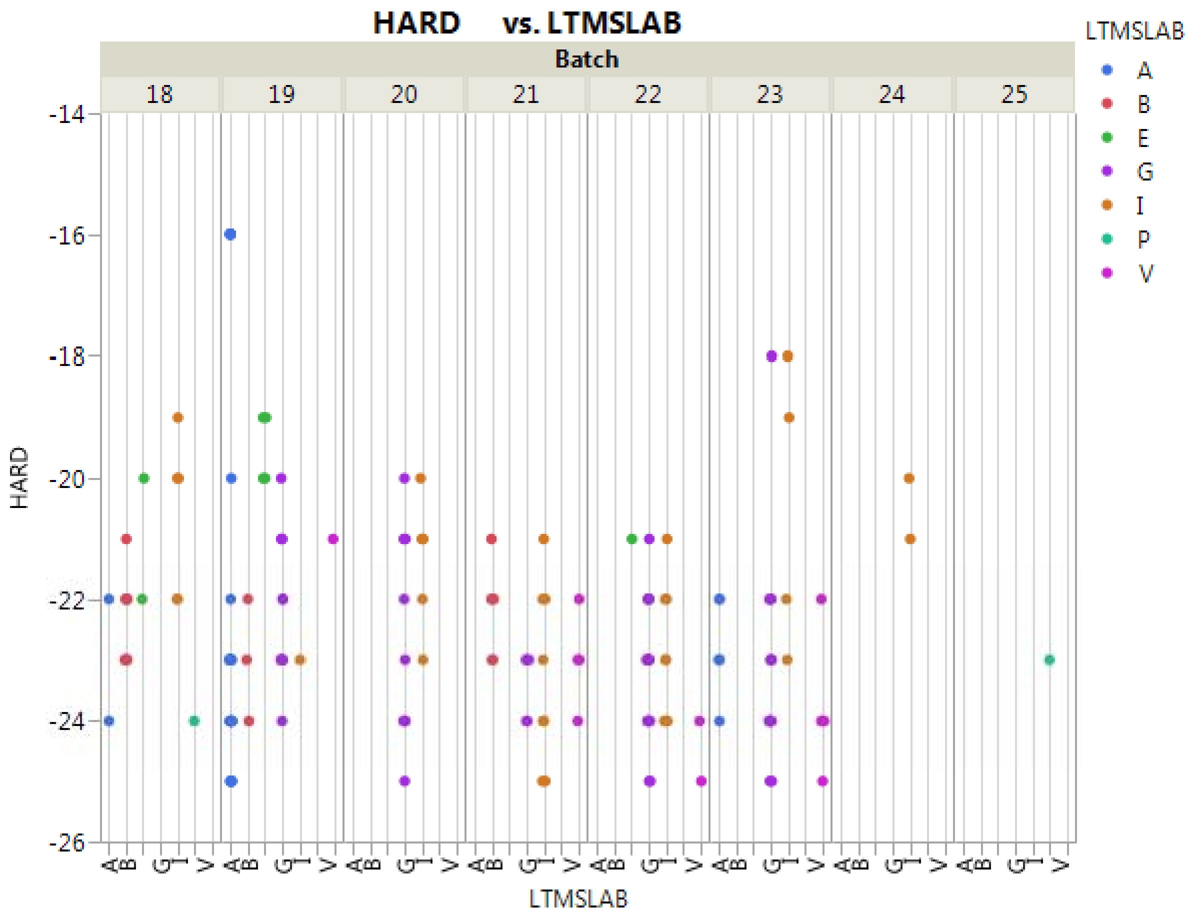


- For each batch, Labs A and B have among the highest absolute HARD and E the lowest.
- Through Batch 15, Lab G's HARD level appears to have made a step chagne.

Individual Silicone HARD by Batch and Lab



Individual Silicone HARD by Batch and Lab (Batches 18 – 25)



For each batch the labs overlap.

Silicone HARD Regression Analysis

- HARD was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table orders the labs by their LS Mean though they are not statistically significantly different.

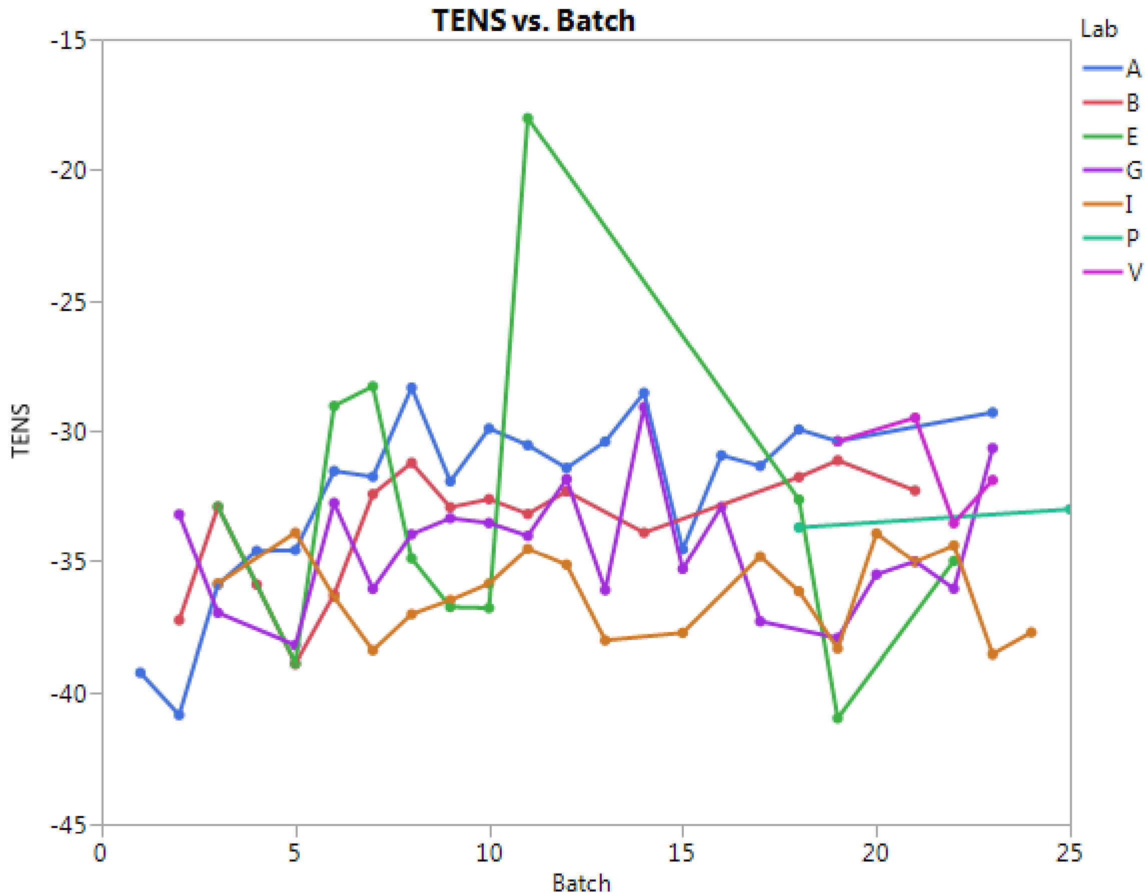
Effect	df	F Ratio	p-Value
Batch	17	13.2892	<.0001
LTMSLAB	6	78.9157	<.0001

Lab	Level	LS Mean
G	1	-20
E	1 2	-21
I	3	-22
V	2 3 4	-22
A	4	-23
B	4	-23
P	3 4	-24

Labs not connected by the same Level (number) are statistically significantly different.

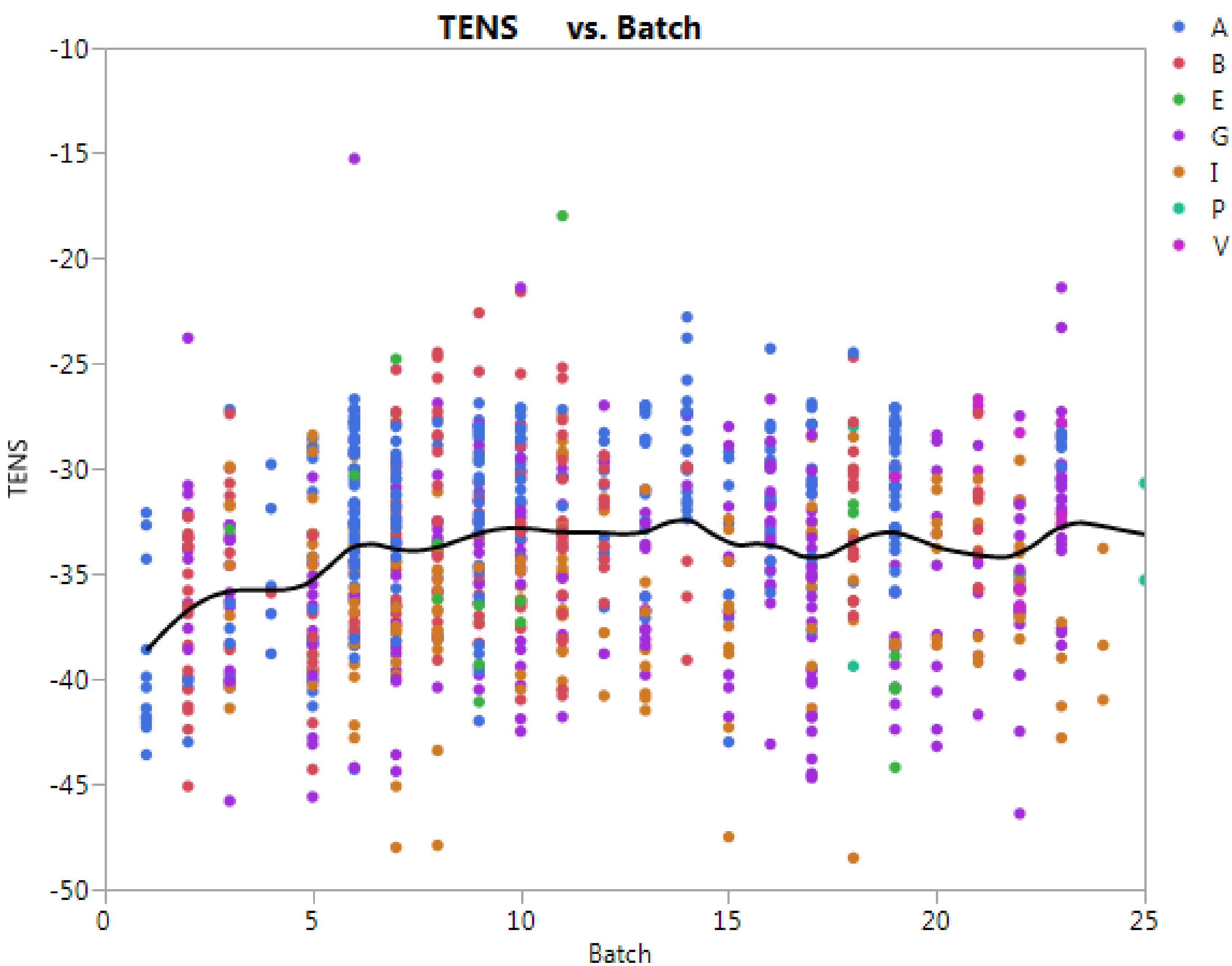
SILICONE TENS

Batch Average Silicone TENS by Lab



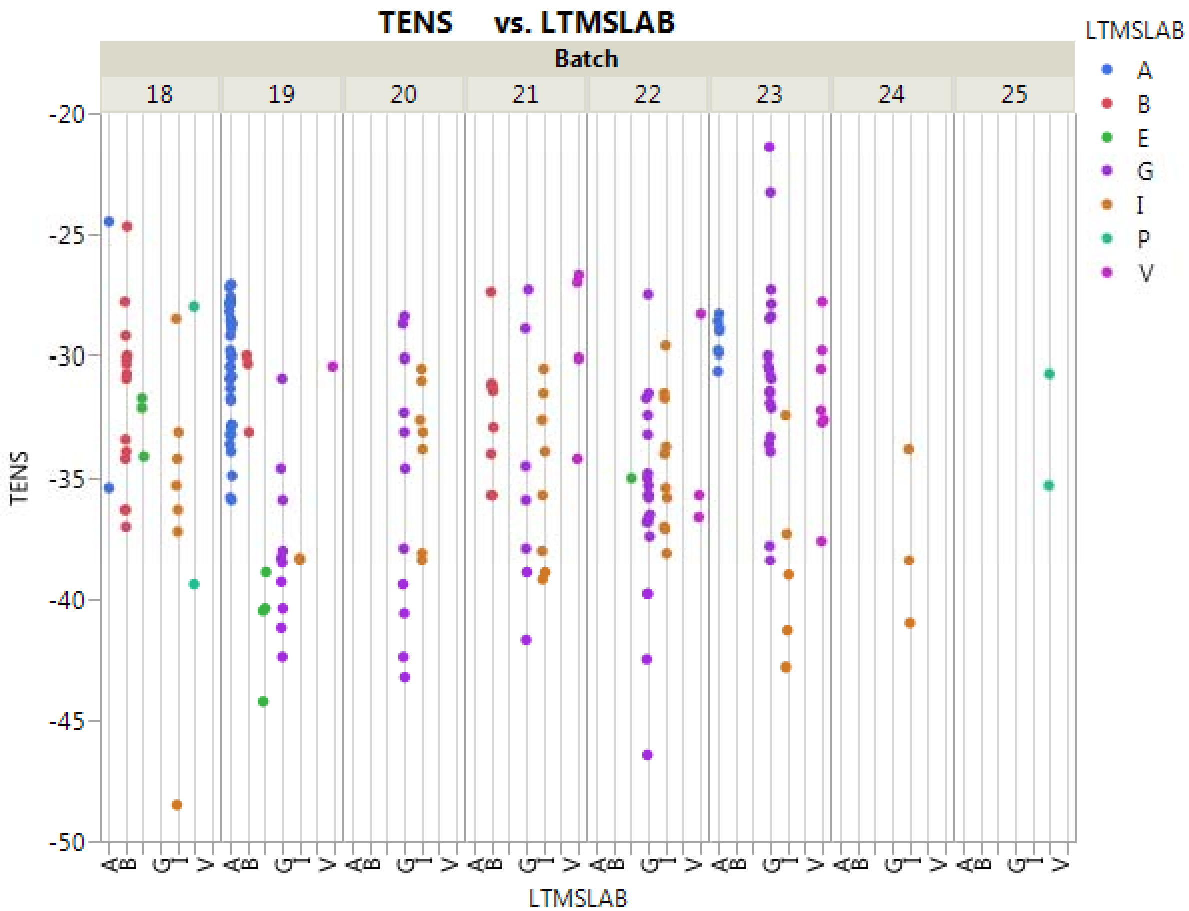
For each batch, Lab A has among the lowest absolute TENS and I among the highest.

Individual Silicone TENS by Batch and Lab



Performance you can rely on.

Individual Silicone TENS by Batch and Lab (Batches 18 – 25)



There is lab overlap in each of the batches.

Silicone TENS Regression Analysis

- TENS was regressed on Batch and Lab.
  - Both Batch and Lab effects are strongly statistically significant.
- The bottom table orders the labs by their LS Mean though they are not statistically significantly different.

Effect	df	F Ratio	p-Value
Batch	17	5.3607	<.0001
LTMSLAB	6	21.1841	<.0001

Lab	Level			LS Mean
A	1			-32
V	1	2	3	-33
B		2		-34
E		2	3	-35
G		2		-35
P	1	2	3	-35
I			3	-36

Labs not connected by the same Level (number) are statistically significantly different.